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ABSTRACT

This publication consists of resource materials related to development of an environmental technology program. Section 1 presents DACUM (Developing a Curriculum process) results, including the following: a chart of duties and task statements, equipment/tools and software lists, future trends, traits/attitudes, techniques, knowledge/skills, validation, and crosswalk. Section 2 provides degree patterns--proposed curricula for an associate degree in environmental technology, certificate for laboratory assistant, and advanced skills certificates. Section 3 consists of course descriptions. Section 4 contains the following sample surveys and models: employer needs survey, student survey, DACUM validation forms, crosswalk forms, crosswalk decision rules, training achievement record, and DACUM verification model. Section 5 provides the Secretary's Commisison on Achieveing Necessary Skills (SCANS) occupational assessment workplace know-how instrument, a sample that shows SCANS incorporation into course activities, and sample SCANS check sheet and student forms. Section 6 presents the following resources: a list of six contacts; 90-item environmental science/hazardous materials management textbooks and reference book list; list of 7 working references; list of 111 nonprofit organizations that offer possible job opportunities; list of 44 environmental publications; list of federal addresses; and articles for background research. Section 7 contains a sample program approval request. Section 8 is a sample application for approval of a new technical education program. (YLB)

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BROOKHAVEN COLLEGE OF THE
DALLAS COUNTY COMMUNITY
COLLEGE DISTRICT

A RESOURCE MANUAL FOR AN
EMERGING OCCUPATION

ENVIRONMENTAL TECHNOLOGY

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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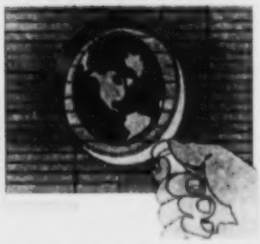

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DACUM RESULTS

Field/Laboratory Technician

November 4th and 5th, 1993
DACUM Coordinated by **Brookhaven College**,
Dallas County Community College District,
with funding from the
Texas Higher Education Coordinating Board,
Carl D. Perkins Vocational and Applied Technology Education Act

Definition: **A Field/Laboratory Technician**

Conducts field and laboratory tests, gathers and processes data for use by engineering, regulatory, and scientific personnel: 1) in determining sources and methods of controlling contaminants, pollutants and harmful or hazardous materials in soil, air, water. 2) in analyzing any product which includes but is not limited to pharmaceuticals, cosmetics, foods, and agriculturals which may impact on health and the environment.

Field/Laboratory Technician Panel

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Rosemary Gray, BeautiControl Cosmetics
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Margot Hirsch, DACUM Panel Facilitator,
Dallas County Community College District

Field/Laboratory Technician

November 4th and 5th 1993

DUTIES		TASK STATEMENTS										
A	**Practice Safety**	Follow OSHA lab/field personnel guidelines A-1	Follow company safety policies A-2	Observe MSDS information A-3	Observe warning labels A-4	Wear personal protective equipment A-5	Work under hood A-6	Store compressed gases and chemicals A-7				
B	**Keep Records**	Keep lab/field notebooks B-1	Document sampling procedures B-2	Maintain chain of custody records B-3	Document sample preparation procedures B-4	Keep standards/reagents log B-5	Keep instrument run log B-6	Keep maintenance log B-7	Keep telephone logs B-8	Keep inventory records B-9	Archive records B-10	
C	**Maintain Equipment**	Order equipment and supplies C-1	Conduct performance checks C-2	Calibrate instruments C-3	Clean equipment C-4	Check personal protective gear C-5	Change fluids C-6	Add gas C-7	Follow manufacturer's recommended maintenance schedules C-8	Replace worn parts C-9		
D	**Implement Sampling Plan**	Implement health and safety plan D-1	Gather equipment D-2	Decontaminate pre- and post-sampling D-3	Operate sampling equipment D-4	Take field measurements D-5	Calculate well purge volumes D-6	Perform field tests D-7	Take physical samples D-8	Filter samples D-9	Split samples D-10	Label samples D-11
"D" Continued					Preserve samples D-12	Decontaminate protective gear D-13	Apply chain of custody seals D-14	Fill out sample chain of custody D-15	Package samples D-16	Fill out shipping chain of custody D-17	Follow DOT and other labeling/shipping requirements D-18	Transport samples D-19
E	**Prepare Samples**	Organize work load E-1	Clean glassware E-2	Retrieve samples E-3	Homogenize samples E-4	Measure samples E-5	Ash samples E-6	Digest Samples E-7	Extract samples E-8	Dilute samples E-9	Clarify samples E-10	

DUTIES		TASK STATEMENTS										
F	**Control Quality**	Monitor measuring devices F-1	Monitor equipment and instrument operating ranges F-2	Perform instrument system suitability F-3	Collect required control samples F-4	Check controls' expiration dates F-5	Run required control samples F-6	Run sterility controls F-7	Monitor lab's environmental status F-8	Compare results to performance standards F-9	Plot control charts F-10	
G	**Perform Lab Tests**	Follow established methodology G-1	Follow equipment operating instructions G-2	Prepare equipment G-3	Prepare reagents and standards G-4	Perform physical tests G-5	Centrifuge samples G-6	Titrate samples G-7	Pipette solutions G-8	Perform quantitative measurements G-9	Perform serial dilutions G-10	Perform analytical dilutions G-11
"G" Continued						Interface with computer G-12	Operate testing equipment G-13	Perform qualitative measurements G-14	Perform plate counts G-15	Perform gram stains G-16	Analyze slides G-17	Store samples G-18
H	**Analyze Data**	Check for contamination H-1	Recognize pattern similarities H-2	Calculate concentrations H-3	Observe chemical/physical reactions H-4	Calculate test results H-5	Decide next-step action H-6					
I	**Interpret Results**	Review data findings I-1	Recognize "Red Flags" I-2	Compare results with action levels I-3	Evaluate results against company's regulatory/ client's criteria I-4	Classify waste I-5						
J	**Relay Information**	Interact with supervisor and peers J-1	Report "Red Flags" J-2	Report the sampling event J-3	Interact with subcontractors J-4	Perform data entry J-5	Report results J-6	Prepare report J-7				
K	**Carry out waste control plan**	Limit waste K-1	Separate waste K-2	Recycle waste K-3	Autoclave trash K-4	Label waste K-5	Store waste K-6	Dispose waste K-7				

Equipment/Tools

volumetric glassware
microscope
gas chromatograph
analytical balance
HPLC - high pressure liquid chromatograph
atomic absorption
spectrophotometer
infrared spectrometer
TLC - thin layer chromotography
pH meter
radiation meter
osmometer
viscometer
refractometer
conductivity meter
particle sizer
camera
OVA - organic vapor analyzer
HNU - brand name for photoionization detector
colonimeter
centrifuge
purge and tap
autoclave
ICP - inductive coupling plasma
dust monitor
autotitrator
sonicator
autoanalyzer
fire extinguisher
bailer
hand auger
pipette bulb
power auger
H_2O level indicator
thermometer
buret
compass
safety equipment
metal detector
PC-computer
calculator
ion chromatograph
H_20 purification system
aquameter
heating mantle
H_2O bath
muffle furnace

Software

WordPerfect
Lotus
Windows
Word for Windows
Works
Paradox
Quatro Pro
LIMS - (P. E. Nelson, SAM) laboratory
Information Management Systems
Pro Stat
Lab Stat
1st Choice
GIS - Geographic Information Systems (demographic data)
AUTO-CAD
Enviro-CAD

*Represents software used by panelists, November, 1993, and is subject to change.

Future Trends

- Clean Air Act - closer monitoring of air in buildings, etc.
- intensified waste management efforts
- increased FDA requirements for trained personnel
- increased demands for nutritional analysis
- analyses becoming more complex and detailed
- associate degree level people hired for entry level positions
- increased marketability for associate degree graduates
- part time, contract and full time opportunities available
- more employers paying for additional education
- increased use of automation, e.g.
    - processing of samples
    - use of bar codes
    - use of robotics
- computer based instrumentation
- increased use of mobile laboratories
- increased concerns for preservation of ecosystem, e.g.
    - ecosystem "friendly" sampling techniques
- increased emphasis on biological sciences
- fewer raises or smaller raises

Techniques

titration
distillation
sonication
filtration
weighing
pipetting
dilutions
centrifuging
extracting
homogenization
calibration
aliquoting
field techniques
bailing
decontaminating
glassware preparation
autoclaving
media prep
measure pH
conductivity
sampling technique
vacuum pump technique
change a column
  (GC & HPLC)
change a lamp
hook up gas cylinder
use a gas regulator

Traits/Attitudes

common sense
detail-oriented
consistency
adaptability
flexibility
  able to perform multiple tasks
team player
reliability
discreet
patience
good grooming and good personal hygiene
eye hand coordination for the motor skills
handles stress
able to handle criticism
mechanically oriented
handle weather in field
physically fit to do job
honest
works well with general public and people in general
good communicator
responsible
professional manner
good sense of humor

Knowledge/Skills

computer literacy
basic math - thru algebra and statistics
basic chemistry - thru general chemistry
earth science
instrumentation
communication: oral and written
technical writing
laboratory techniques:
  volumetrics, pipetting, weighing, quantitative transfer
field and laboratory safety
troubleshooting
legible writing
first aid and CPR
OSHA regulations
industry-specific industrial compliance regulations
read and comprehend procedures
follow procedures and directions
laboratory terminology and techniques
overview of specific industry
waste classification and regulation
chain of custody procedures
quality assurance/quality control

ENVIRONMENTAL TECHNOLOGY

DACUM Validation

	Priority of Task							Frequency of Task Performance								
	Essential	Very Important	Important	Moderately important	Not Important	Don't Know		Daily	Weekly	Monthly	Quarterly	Yearly	Don't Know		Expected to know when hired	Can learn on the job
A Practice Safety																
A-1 Follow OSHA lab/field personnel guidelines	58	15	18	1	1	1		89	1	0	1	0	3		19	72
A-2 Follow company safety policies	68	22	6	1	0	0		93	1	1	0	0	0		8	88
A-3 Observe MSDS information	47	22	18	4	1	4		67	11	3	1	0	8		29	64
A-4 Observe warning labels	67	19	11	1	0	0		86	1	0	0	0	3		67	29
A-5 Wear personal protective equipment	69	14	14	1	0	0		81	4	1	0	0	4		53	40
A-6 Work under hood	50	18	22	6	0	3		75	4	4	0	0	6		67	29
A-7 Store compressed gases and chemicals	49	24	21	6	0	0		58	15	7	0	0	6		44	50
B Keep Records																
B-1 Keep lab/field notebooks	63	25	10	1	1	0		85	3	0	0	0	1		65	29
B-2 Document sampling procedures	43	24	17	11	3	1		65	7	4	3	0	8		43	51
B-3 Maintain chain of custody records	44	18	15	11	1	7		57	10	4	1	0	18		32	60
B-4 Document sample preparation procedures	40	28	17	13	0	1		67	10	4	3	0	8		49	47
B-5 Keep standards/reagents log	28	31	19	14	3	3		39	29	7	1	0	11		31	63
B-6 Keep instrument run log	26	26	28	15	1	3		51	24	7	0	0	7		31	65
B-7 Keep maintenance log	22	22	32	19	3	1		29	28	21	0	1	8		25	72
B-8 Keep telephone logs	11	14	19	18	24	14		42	15	10	1	1	19		14	78
B-9 Keep inventory records	17	13	32	24	10	3		18	22	25	6	7	10		13	83
B-10 Archive records	19	7	31	28	8	6		8	11	33	10	13	14		8	86
C Maintain Equipment																
C-1 Order equipment and supplies	6	21	40	15	13	4		3	29	33	4	4	7		18	74
C-2 Conduct performance checks	14	33	29	14	1	7		24	35	13	1	1	10		24	64
C-3 Calibrate instruments	43	33	11	6	1	4		38	22	11	3	1	8		35	54
C-4 Clean equipment	31	29	21	14	0	1		49	22	8	0	0	4		44	50
C-5 Check personal protective gear	38	31	17	11	0	3		47	18	8	3	0	7		42	51
C-6 Change fluids	11	18	25	15	1	22		13	24	8	6	0	31		14	67
C-7 Add gas	10	17	18	14	1	32		10	22	4	4	0	39		13	65
C-8 Follow manufacturer's recommended maintenance schedules	18	26	38	15	0	1		17	13	31	8	3	11		14	82
C-9 Replace worn parts	15	24	25	19	7	6		10	14	22	14	4	15		14	76

ENVIRONMENTAL TECHNOLOGY

DACUM Validation

	Priority of Task							Frequency of Task Performance								
	Essential	Very Important	Important	Moderately important	Not Important	Don't Know		Daily	Weekly	Monthly	Quarterly	Yearly	Don't Know		Expected to know when hired	Can learn on the job
D Implement Sampling Plan																
D-1 Implement health and safety plan	39	21	13	8	1	11		53	4	7	4	1	15		18	63
D-2 Gather equipment	18	22	21	13	4	15		36	13	4	1	3	24		21	58
D-3 Decontaminate pre- and post-sampling	36	25	10	6	1	15		47	10	1	0	1	22		25	53
D-4 Operate sampling equipment	32	26	15	7	0	11		49	14	0	0	1	19		24	54
D-5 Take field measurements	28	24	17	4	1	15		36	14	4	0	1	28		28	49
D-6 Calculate well purge volumes	17	11	7	8	3	42		17	11	3	1	1	47		11	50
D-7 Perform field tests	26	21	17	7	1	19		28	17	4	0	1	29		22	54
D-8 Take physical samples	26	25	21	3	1	13		38	18	1	0	1	22		35	43
D-9 Filter samples	24	24	18	7	1	17		39	17	0	0	1	25		49	28
D-10 Split samples	19	22	21	11	1	15		38	15	3	1	1	25		42	35
D-11 Label samples	50	24	8	3	0	8		60	11	0	0	1	14		49	32
D-12 Preserve samples	33	29	8	6	0	14		47	13	0	0	1	19		38	36
D-13 Decontaminate protective gear	36	14	19	4	0	18		39	15	1	0	1	25		24	50
D-14 Apply chain of custody seals	25	17	14	6	3	28		33	8	4	0	1	35		17	53
D-15 Fill out sample chain of custody	33	15	10	6	3	25		39	7	3	0	1	32		19	53
D-16 Package samples	14	25	19	8	4	21		33	11	6	0	3	28		17	58
D-17 Fill out shipping chain of custody	22	15	17	4	3	31		33	7	4	0	1	36		14	58
D-18 Follow DOT and other labeling/shipping requirements	36	21	14	6	1	15		33	14	7	1	1	24		17	60
D-19 Transport samples	13	17	17	10	11	22		24	17	3	1	4	31		19	47
E Prepare Samples																
E-1 Organize work load	28	31	21	11	3	1		54	19	4	1	0	3		49	43
E-2 Clean glassware	46	28	13	4	3	1		65	13	0	0	1	4		68	24
E-3 Retrieve samples	31	25	18	6	6	10		50	14	1	0	0	15		36	49
E-4 Homogenize samples	25	26	19	8	1	13		44	13	1	0	0	21		49	35
E-5 Measure samples	38	28	17	3	1	7		53	8	1	0	0	17		65	19
E-6 Ash samples	22	25	19	6	4	15		36	15	6	0	1	21		47	33
E-7 Digest Samples	25	26	14	4	4	17		40	14	3	0	0	22		46	33
E-8 Extract samples	29	25	17	6	1	13		44	11	3	1	0	19		51	32
E-9 Dilute samples	36	25	15	1	1	13		47	8	3	0	0	19		60	24
E-10 Clarify samples	26	24	18	4	4	15		39	13	6	0	0	21		43	36

ENVIRONMENTAL TECHNOLOGY

DACUM Validation

	Priority of Task							Frequency of Task Performance								
	Essential	Very Important	Important	Moderately important	Not Important	Don't Know		Daily	Weekly	Monthly	Quarterly	Yearly	Don't Know		Expected to know when hired	Can learn on the job
F Control Quality																
F-1 Monitor measuring devices	39	31	17	4	0	4		51	18	4	1	1	7		36	50
F-2 Monitor equipment and instrument operating ranges	32	29	25	4	0	3		50	21	7	0	0	7		28	58
F-3 Perform instrument system suitability	26	22	17	7	6	17		29	17	11	1	1	25		22	33
F-4 Collect required control samples	36	28	17	4	1	8		44	14	6	1	0	18		36	47
F-5 Check controls' expiration dates	40	24	17	6	1	8		39	25	7	1	0	15		40	43
F-6 Run required control samples	44	25	11	7	0	6		43	18	8	0	0	13		36	50
F-7 Run sterility controls	22	18	8	0	3	31		19	15	7	0	0	40		21	42
F-8 Monitor lab's environmental status	14	22	26	11	6	13		21	17	21	0	3	21		17	61
F-9 Compare results to performance standards	33	33	17	7	0	6		39	25	7	3	1	13		42	47
F-10 Plot control charts	25	18	21	13	4	14		25	24	11	1	3	21		39	42
G Perform Lab Tests																
G-1 Follow established methodology	61	26	10	0	0	0		82	3	0	0	0	3		51	42
G-2 Follow equipment operating instructions	61	24	13	0	0	0		79	8	0	0	0	1		44	49
G-3 Prepare equipment	47	28	19	1	0	1		69	7	1	1	0	6		25	64
G-4 Prepare reagents and standards	51	21	17	3	0	3		42	28	7	0	0	7		64	25
G-5 Perform physical tests	47	25	17	3	0	4		61	13	1	1	0	8		53	36
G-6 Centrifuge samples	31	24	15	10	3	13		51	8	3	1	0	18		65	19
G-7 Titrate samples	39	22	21	4	0	8		61	8	1	0	0	13		72	17
G-8 Pipette solutions	42	21	19	3	0	8		63	4	0	1	0	13		74	14
G-9 Perform quantitative measurements	53	26	13	3	0	1		72	7	1	1	0	6		72	21
G-10 Perform serial dilutions	39	28	11	4	1	8		57	8	1	1	0	15		67	19
G-11 Perform analytical dilutions	40	29	11	3	1	7		60	8	0	0	0	15		68	19
G-12 Interface with computer	33	19	25	8	3	4		68	10	1	0	0	10		42	51
G-13 Operate testing equipment	47	24	14	4	0	3		72	3	0	0	0	10		32	50
G-14 Perform qualitative measurements	33	29	22	6	3	0		63	10	4	1	0	8		53	39
G-15 Perform plate counts	19	13	8	13	3	33		28	7	0	3	0	44		28	36
G-16 Perform gram stains	18	13	8	11	6	32		25	7	0	3	1	44		28	36
G-17 Analyze slides	14	18	8	13	6	29		24	6	4	4	1	42		29	36
G-18 Store samples	26	22	15	15	6	4		57	8	1	3	0	13		32	54

ENVIRONMENTAL
TECHNOLOGY

DACUM Validation

	Priority of Task							Frequency of Task Performance								
	Essential	Very Important	Important	Moderately important	Not Important	Don't Know		Daily	Weekly	Monthly	Quarterly	Yearly	Don't Know		Expected to know when hired	Can learn on the job
H Analyze Data																
H-1 Check for contamination	40	32	13	7	0	1		76	6	1	0	0	4		40	49
H-2 Recognize pattern similarities	26	28	31	1	4	3		60	13	3	0	0	10		42	47
H-3 Calculate concentrations	47	26	13	1	1	1		68	6	1	1	0	8		67	22
H-4 Observe chemical/physical reactions	43	21	17	8	1	1		72	3	1	1	1	7		58	28
H-5 Calculate test results	51	19	21	3	0	0		75	4	1	0	0	7		61	31
H-6 Decide next-step action	24	23	20	17	1	1		61	11	0	0	0	10		29	53
I Interpret Results																
I-1 Review data findings	26	33	25	6	3	0		47	22	6	0	0	8		47	43
I-2 Recognize "Red Flags"	31	35	15	7	1	4		54	15	1	0	0	13		36	51
I-3 Compare results with action levels	24	22	25	10	4	8		49	19	1	0	1	17		29	54
I-4 Evaluate results against company's regulatory/client's criteria	33	26	18	6	4	4		51	18	1	0	1	11		18	65
I-5 Classify waste	18	19	32	13	4	7		40	19	8	1	0	11		19	63
J Relay Information																
J-1 Interact with supervisory and peers	56	29	10	1	0	0		79	6	1	0	0	0		63	31
J-2 Report "Red Flags"	50	29	8	3	1	4		69	7	1	0	0	8		35	56
J-3 Report the sampling event	35	22	17	6	4	7		54	14	0	0	1	14		29	51
J-4 Interact with subcontractors	15	13	32	14	7	13		24	18	11	0	4	26		17	65
J-5 Perform data entry	46	17	19	11	0	1		64	11	1	0	0	8		50	43
J-6 Report results	49	24	18	3	1	0		61	11	4	1	0	6		46	47
J-7 Prepare report	29	19	26	10	6	1		36	13	14	1	0	13		40	47
K Carry out waste control plan																
K-1 Limit waste	21	29	19	14	3	7		54	13	4	1	0	13		25	58
K-2 Separate waste	22	25	21	15	4	6		42	18	6	0	0	13		25	60
K-3 Recycle waste	14	25	21	17	4	13		35	18	8	4	0	17		18	63
K-4 Autoclave trash	14	14	14	8	11	31		21	13	6	3	0	36		13	56
K-5 Label waste	36	26	19	8	1	3		50	14	4	1	0	13		28	60
K-6 Store waste	28	24	25	7	6	4		40	21	3	0	1	14		17	68
K-7 Dispose waste	29	25	18	10	6	6		28	18	15	4	3	14		13	75

Do you perform lab work on a regular basis?	Yes 39	No 56
Do you perform field work on a regular basis?	Yes 15	No 81
Do you supervise lab workers on a regular basis?	Yes 57	No 39
Do you supervise field workers on a regular basis?	Yes 25	No 69
Are you employed in industry?	Yes 46	No 49
Do you have teaching responsibilities in a college or university?	Yes 24	No 72

ENVIRONMENTAL TECHNOLOGY

CROSSWALK FROM DACUM

	General Chemistry 101/102	Intro to ENVT	Sampling and Field Testing	Hazardous Materials	Quantitative Analysis	Instrumental Analysis	Advanced Instrumentation	Biochemical Processes	ENVT II	Environmental Calculations	Industrial Processes
A Practice Safety											
A-1 Follow OSHA lab/field personnel guidelines	C1	P2	P3	C3	C2	C2	C3	C2			C2
A-2 Follow company safety policies		C2			C2	C2	C3	C2			C3
A-3 Observe MSDS information	C1	C2	C2	A2	C2	C2	C3	C2			C3
A-4 Observe warning labels	C1	C1	C2		C2	C2	C3	C2			
A-5 Wear personal protective equipment	P1	C2	P2	C3	C2	C2	C3	C2			
A-6 Work under hood	P1	C2	P2	C2	C2	C2	C3	C2			
A-7 Store compressed gases and chemicals	C1	C1	P2	C3	C2	C2	C3	C2			
B Keep Records											
B-1 Keep lab/field notebooks	P1		P2	C2	P2	P2	P3	P2	C2		C3
B-2 Document sampling procedures			P2	C2	P2	P2	P3	P2	C2		C3
B-3 Maintain chain of custody records			P2	C2	P2	P2	P3	P2	C2		C3
B-4 Document sample preparation procedures	P1		P2	C2	P2	P2	P3	P2	C2		C3
B-5 Keep standards/reagents log			P2	C2	P2	P2	P3	P2	C2		C3
B-6 Keep instrument run log			P2	C2	P2	P2	P3	P2	C2		C3
B-7 Keep maintenance log			P1	C2	P2	P2	P3	P2	C2		C3
B-8 Keep telephone logs				C2			P3		C2		C3
B-9 Keep inventory records				C2			P3		C2		C3
B-10 Archive records				C2			P3		C2		C3
C Maintain Equipment											
C-1 Order equipment and supplies							P3				C2
C-2 Conduct performance checks			P2	C2	P1	P2	P3	P2			C2
C-3 Calibrate instruments	C1		P2		P1	P2	P3	P2			C2
C-4 Clean equipment			P2		P1	P2	P3	P2			C2
C-5 Check personal protective gear			P2	C2	P1	P2	P3	P2			C2
C-6 Change fluids						P1	P3				C2
C-7 Add gas						P1	P3				C2
C-8 Follow manufacturer's recommended maintenance schedules						P1	P3				C2
C-9 Replace worn parts						P1	P3				C2

ENVIRONMENTAL TECHNOLOGY

	General Chemistry 101/102		Intro to ENVT		Sampling and Field Testing		Hazardous Materials		Quantitative Analysis		Instrumental Analysis		Advanced Instrumentation		Biochemical Processes		ENVT II		Environmental Calculations		Industrial Processes
D Implement Sampling Plan																					
D-1 Implement health and safety plan			C1		P3																
D-2 Gather equipment					P3																
D-3 Decontaminate pre- and post- sampling			C1		P3																
D-4 Operate sampling equipment					P3																
D-5 Take field measurements					P3																
D-6 Calculate well purge volumes					P3																
D-7 Perform field tests					P3																
D-8 Take physical samples					P3																
D-9 Filter samples					P3				P2		P2		P2								
D-10 Split samples					P3				P2		P2		P2								
D-11 Label samples					P3				P2		P2		P2								
D-12 Preserve samples					P3				P2		P2		P2								
D-13 Decontaminate protective gear			C1		P3		C2														
D-14 Apply chain of custody seals			C1		P3																C2
D-15 Fill out sample chain of custody			C1		P3																C2
D-16 Package samples			C1		P3																C2
D-17 Fill out shipping chain of custody			C1		P3																C2
D-18 Follow DOT and other labeling/shipping requirements			C1		P3																C2
D-19 Transport samples			C1		P3																C2
E Prepare Samples																					
E-1 Organize work load	C1				P2				P1		P2		P3		P2						P2
E-2 Clean glassware	P1				P3				P3		P3		P3		P3						
E-3 Retrieve samples	P1				P3				P3		P3		P3		P3						
E-4 Homogenize samples					P3								P3		P2						
E-5 Measure samples	P1				P3				P2		P3		P3		P2				P2		
E-6 Ash samples									P2		P3		P3						P2		
E-7 Digest Samples									P2		P3		P3						P2		
E-8 Extract samples					P3				P2		P3		P3						P2		
E-9 Dilute samples	P1				P3				P2		P3		P3		P3				P2		
E-10 Clarify samples					P3				P2		P3		P3						P2		

ENVIRONMENTAL TECHNOLOGY

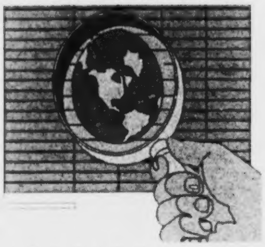
Page 3

	General Chemistry 101/102	Intro to ENVT	Sampling and Field Testing	Hazardous Materials	Quantitative Analysis	Instrumental Analysis	Advanced Instrumentation	Biochemical Processes	ENVT II	Environmental Calculations	Industrial Processes
F Control Quality											
F-1 Monitor measuring devices			P2		P2	P2	P3	P3			C2
F-2 Monitor equipment and instrument operating ranges			P2		P2	P2	P3	P3			C2
F-3 Perform instrument system suitability			P2		P2	P2	P3	P3			C2
F-4 Collect required control samples			P3		P2	P2	P3	P3		P2	C2
F-5 Check controls' expiration dates			A2		A2	A2	A2	A2			C2
F-6 Run required control samples			A2		A2	A2	A2	A2			C2
F-7 Run sterility controls			A2				A2				C2
F-8 Monitor lab's environmental status					C1	P1	P2	P2		P2	C2
F-9 Compare results to performance standards			C2		C2	C2	C3	C2		P2	C2
F-10 Plot control charts			P2		P1	P2	P2	P2		P2	C2
G Perform Lab Tests											
G-1 Follow established methodology	P1		P2	C2	P2	P2	P2	P2		P2	
G-2 Follow equipment operating instructions	P1		P2		P2	P2	P2	P2			
G-3 Prepare equipment	P1		P2		P2	P2	P2	P2			
G-4 Prepare reagents and standards	C1		P2		P2	P2	P2	P2		P2	
G-5 Perform physical tests	P1		P2		P2	P2	P2	P2			
G-6 Centrifuge samples			P2		P2	P2	P2	P2			
G-7 Titrate samples	P1		P2		P2	P2	P2	P2		P2	
G-8 Pipette solutions	P1		P2		P2	P2	P2	P2			
G-9 Perform quantitative measurements	P1		P2		P3	P2	P3	P2			
G-10 Perform serial dilutions								P3		P2	
G-11 Perform analytical dilutions	P1		P2		P3	P3	P3			P2	
G-12 Interface with computer		C1	P2	P2		P2	P3	P2	C2	P2	
G-13 Operate testing equipment	P1		P2		P2	P2	P3	P2			
G-14 Perform qualitative measurements	P2		P2					P2			
G-15 Perform plate counts								P3		P2	
G-16 Perform gram stains								P3			
G-17 Analyze slides								P3			
G-18 Store samples				C3				P2			

ENVIRONMENTAL TECHNOLOGY

Page 4

	General Chemistry 101/102		Intro to ENVT		Sampling and Field Testing		Hazardous Materials		Quantitative Analysis		Instrumental Analysis		Advanced Instrumentation		Biochemical Processes		ENVT II		Environmental Calculations		Industrial Processes
H Analyze Data																					
H-1 Check for contamination					P2				P2		P2		P3		P3						
H-2 Recognize pattern similarities	P1				P2				P2		P2		P3		P2						
H-3 Calculate concentrations	P1				P2				P2		P2		P3						P2		
H-4 Observe chemical/physical reactions	P2				P2				P2		P2		P3		P2						
H-5 Calculate test results	P2				P2				P2		P2		P3		P2				P2		
H-6 Decide next-step action	C1				P2				P2		P2		P3		C2						
I Interpret Results																					
I-1 Review data findings	C1		C2		P2		C3		P2		P2		P3		C2		C3				C3
I-2 Recognize "Red Flags"			C2		P2		C3		P2		P2		P3		C2		C3				C3
I-3 Compare results with action levels	C1		C2		P2		C3		P2		P2		P3		C2		C3				C3
I-4 Evaluate results against company's regulatory/client's criteria			C2		P2		C3		P2		P2		P3		C2		C3				C3
I-5 Classify waste	C1		C2		P2		C3		P2		P2		P3		C2		C3				C3
J Relay Information																					
J-1 Interact with supervisory and peers	C1		C1		A2				A1		A2		A2		A1		C2				C3
J-2 Report "Red Flags"			C1		P2				P2		P2		P3		P2		C2				C3
J-3 Report the sampling event			C1		P2				P2		P2		P3		P2		C2				C3
J-4 Interact with subcontractors			C1		P2								P3				C2				C3
J-5 Perform data entry	P1		C1		P2				P2		P2		P3		P2		C2				C3
J-6 Report results	P1		C1		P2				P2		P2		P3		P2		C2				C3
J-7 Prepare report	P1		C1		P2		P2		P2		P2		P3		P2		C2				C3
K Carry out waste control plan																					
K-1 Limit waste	C1		C2		P2		C3		P2		P2		P3				C2				C3
K-2 Separate waste	P1		C2		P2		C3		P2		P2		P3		P2		C2				C3
K-3 Recycle waste			C2		P2		C3		P2		P2		P3				C2				C3
K-4 Autoclave trash			C2		P2		C3								P2		C2				C3
K-5 Label waste	C1		C2		P2		C3		P2		P2		P3		P2		C2				C3
K-6 Store waste	C1		C2		P2		C3		P2		P2		C3		P2		C2				C3
K-7 Dispose waste	C1		C2		P2		C3		P1		C2		C3		P2		C2				C3



DEGREE PATTERNS

BROOKHAVEN COLLEGE **FICE CODE: 029150**

PROPOSED CURRICULUM

ASSOCIATE DEGREE IN ENVIRONMENTAL TECHNOLOGY
1994-95

SEMESTER I

			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	101	Introduction to Environmental Science and Safety	2	3	80	3
CHM	101	General Chemistry	3	3	96	4
ENG	101*	Composition I	3	0	48	3
MTH	101*	College Algebra	3	0	48	3
Elective		Behavioral/Social Science	3	0	48	3
	TOTAL HOURS		14	6	320	16

SEMESTER II

			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	102	Documentation Techniques	2	3	80	3
CHM	102	General Chemistry	3	3	96	4
BIO	223	Environmental Biology	3	3	96	3
SC	101*	Introduction to Speech Communication	3	0	48	3
CMT	124	Electrical and Mechanical Equipment	3	3	96	4
	TOTAL HOURS		14	12	416	17

SEMESTER III

			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
CHM	203	Quantitative Analysis	2	6	128	4
ENV	105	Chemical Processes	3	3	96	4
ENV	106	Calculations for Environmental Technology	2	0	32	2
ENV	202	Hazardous Materials	3	0	48	3
ENV	206	Industrial Processes and Procedures	3	0	48	3
	TOTAL HOURS		13	9	352	16

* NOTE: SACS General Education Courses are underlined.

PROPOSED 1994-95 CURRICULUM - PAGE 2

SEMESTER IV

			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
CHM	234	Instrumental Analysis	2	6	128	4
ENV	201	Field Sampling and Testing	2	6	128	4
ENV	703	Cooperative Work Experience	1	15	256	3
Elective		Humanities/Fine Arts	3	0	48	3
Elective		Any non-ENV course	3	0	48	3
	TOTAL HOURS		11	27	608	17
	GRAND TOTAL				1696	66

* **NOTE: SACS General Education Requirements are underlined.**

PROPOSED CURRICULUM

CERTIFICATE FOR LABORATORY ASSISTANT
1994-95

SEMESTER I			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	101	Introduction to Environmental Science and Safety	2	3	80	3
CHM	101	General Chemistry	3	3	96	4
ENG	101*	Composition I	3	0	48	3
MTH	101*	College Algebra	3	0	48	3
BIO	223	Environmental Biology	3	3	96	3
		TOTAL HOURS	14	9	368	16

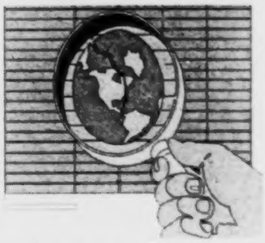
SEMESTER II			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	102	Documentation Techniques	2	3	80	3
CHM	102	General Chemistry	3	3	96	4
ENV	105	Chemical Processes	3	3	96	4
ENV	106	Calculations for Environmental Technology	3	0	48	3
ENV	703	Cooperative Work Experience	1	15	256	3
		TOTAL HOURS	12	24	576	17
		GRAND TOTAL			944	33

PROPOSED CURRICULUM

ADVANCED SKILLS CERTIFICATES
1994-95

Laboratory Analysis			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	207	Environmental Laboratory Instrumentation	2	6	128	4
ENV	208	Extraction and Analysis of Materials	2	6	128	4
	TOTAL HOURS		4	12	256	8
	GRAND TOTAL				256	8

Regulatory Compliance			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	209	Interpreting Government Regulations	3	0	48	3
ENV	210	Employee Right-to-Know Programs	3	0	48	3
	TOTAL HOURS		6	0	96	6
	GRAND TOTAL				96	6



COURSE DESCRIPTIONS

COURSE DESCRIPTIONS
for
ENVIRONMENTAL TECHNOLOGY

BIO 223 Environmental Biology (3)
The principles of aquatic and terrestrial communities are presented. Emphasis is on the relationship of these principles to the problems facing people in a modern technological society. Laboratory fee. (3 Lec., 3 Lab.)

CHM 101 General Chemistry (4)
Prerequisites: Developmental Mathematics 093 or equivalent and any one of the following: high school chemistry, Chemistry 115, or the equivalent. Fundamental concepts of chemistry are presented including states and properties of matter, the periodic table, chemical reaction types and energy relationships, chemical bonding, atomic and molecular structure, stoichiometry, gas laws and solutions. (3 Lec., 3 Lab.)

CHM 102 General Chemistry (4)
Prerequisite: CHM 101. Continuation of CHM 101. Previously learned and new concepts are applied. Topics include reaction kinetics and chemical equilibrium, acids, bases, salts and buffers, thermodynamics, colligative properties of solutions, electrochemistry, transition-metal chemistry, nuclear chemistry, qualitative inorganic analysis and an introduction to organic chemistry. (3 Lec., 3 Lab.)

CHM 203 Quantitative Analysis (4)
Prerequisites: CHM 102 and MTH 101. A survey of methods used in analytical chemistry: gravimetric and volumetric methods based on equilibria, oxidation-reduction, and acid-base theory, spectrophotometry, chromatography, and electroanalytical chemistry. (2 Lec., 6 Lab.)

CHM 234 Instrumental Analysis (4)
Prerequisites: Chemistry 203 or demonstrated competence approved by the instructor. The role of modern electronic instrumentation in analysis is explored. Topics include infrared and ultraviolet spectroscopy, gas chromatography, potentiometric titration, electrochemistry, continuous flow analysis, scintillation counting, electrophoresis, flame photometry, and atomic absorption spectrophotometry as analytical tools. (2 Lec., 6 Lab.)

CMT 124 Electrical and Mechanical Equipment (4)
The nature and use of materials and equipment in various systems are explained. Included are plumbing, heating, ventilation, air conditioning, electrical, and conveying systems. (3 Lec., 3 Lab.)

ENG 101 Composition I (3)
Prerequisite: An appropriate assessment test score (ACT, DCCCD test, or SAT). This course focuses on student writing. It emphasizes reading and analytical thinking and introduces research skills. Students practice writing for a variety of audiences and purposes. (3 Lec.)

*** ENV 207 Environmental Laboratory Instrumentation (4)**
Prerequisite: AAS in Environmental Technology. This course provides calibration, maintenance, and troubleshooting of instrumentation used for analysis. Topics include atomic absorption, gas chromatography, ultraviolet/visible spectroscopy, high performance liquid chromatography, Fourier Transform infrared spectrometry, light microscope, protective gear, use of computer interfaces, and an introduction to quality control procedures, including instrument checks. (2 Lec., 6 Lab.)

*** ENV 208 Extraction and Analysis of Materials (4)**
Prerequisite: AAS in Environmental Technology. This course provides methods for extraction of analytes from complex matrices for instrumental analysis. (2 Lec., 6 Lab.)

*** ENV 209 Interpreting Government Regulations (3)**
Prerequisite: AAS in Environmental Technology. This course presents a summary of regulations which impact environmental technology from various government agencies. (3 Lec.)

*** ENV 210 Employee Right-to-Know Programs (3)**
Prerequisite: AAS in Environmental Technology. This course provides instruction for the design and development of Employee Right-to-Know programs for use in environmental technology. (3 Lec.)

*** ENV 703 Cooperative Work Experience (3)**
Prerequisites: Completion of two courses in the Environmental Technology program or instructor approval. This course combines productive work experience with academic study. The student, employer, and instructor will develop a written competency-based learning plan with varied learning objectives and work experiences. Student smust develop new learning objectives each semester. The seminar consists of topics which include job interview and job application techniques, job site interpersonal relations, and employer expectations of employees. (1 Lec., 15 Lab.)

MTH 101 College Algebra (3)
Prerequisites: Two years of high school algebra and an appropriate assessment test score or Developmental Mathematics 093. This course is a study of relations and functions including polynomial, rational, exponential, logarithmic, and special functions. Other topics include variation, complex numbers, systems of equations and inequalities, theory of equations, progressions, the binomial theorem, proofs, and applications. (3 Lec.)

SC 101 Introduction to Speech Communication (3)
Theory and practice of speech communication behavior in one-to-one, small group, and public communication situations are introduced. Students learn more about themselves, improve skills in communicating with others, and make formal oral presentations. This course requires college-level skills in reading and writing. (3 Lec.)

*** DENOTES NEW COURSES**

* **ENV 101 Introduction to Environmental Science and Safety (3)**
Prerequisites: High school chemistry or Chemistry 115; Developmental Math 093 or equivalent. This course is an introduction to environmental technology. Topics covered include fundamental concepts and considerations of environmental chemicals, including sources and remediation of pollution and contamination of air, water, soil, and consumer products, and an introduction to basic safety practices and procedures. (2 Lec., 3 Lab.)

* **ENV 102 Documentation Techniques (3)**
Prerequisites: ENV 101 and CHM 101. This course provides the fundamentals of field and laboratory record-keeping, documentation procedures, and basic report writing using the computer. (2 Lec., 3 Lab.)

* **ENV 105 Chemical Processes (4)**
Prerequisite: CHM 101. This course provides instruction on chemical processes. Topics include a survey of organic and biochemical reactions, syntheses, nomenclature, uses and purposes and properties of the important classes of organic and biochemical compounds, fundamental biochemical pathways and molecules, and microbial processes and procedures. (3 Lec., 3 Lab.)

* **ENV 106 Calculations for Environmental Technology (2)**
Prerequisites: CHM 101 and MTH 101. This course combines applications of math skills and chemical knowledge for solving problems in the environment. Topics include calculation of concentrations in split and diluted samples, simple statistical analysis, methods for determination of number of control and collected samples, control chart construction, calculations for reagent and standards preparation, and calculations for microbial testing. (2 Lec.)

* **ENV 201 Field Sampling and Testing (4)**
Prerequisite: CHM 203. This course provides instruction on sampling and testing procedures for environmental problems in air, soil, water, and product contamination. Topics include sample selection, collection, treatment, testing, storage, packing and shipping, data collection, and interface with computer analytical systems. (2 Lec., 6 Lab.)

* **ENV 202 Hazardous Materials (3)**
Prerequisites: CHM 102 and ENV 102. This course provides an in-depth study of hazardous materials, including modes of action, appropriate documentation, handling procedures, waste classification and disposal. (3 Lec.)

* **ENV 206 Industrial Processes and Procedures (3)**
Prerequisites: CHM 102 and ENV 102. This course provides an overview of industrial chemical processes. Topics include catalytic cracking, hydrogenation, ethoxylation, sulfonation, and distillation and desalting. (3 Lec.)

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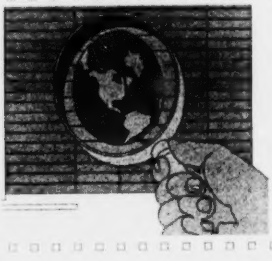

SAMPLE SURVEYS AND MODELS

Brookhaven College

XV
BROOKHAVEN COLLEGE
15th ANNIVERSARY

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BROOKHAVEN COLLEGE IS A
MEMBER OF THE DALLAS
COUNTY COMMUNITY
COLLEGE DISTRICT.

Educational opportunities are offered by the Dallas County Community College District without regard to race, color, age, national origin, religion, sex, or handicap.

April 15, 1994

Dear Professional:

Brookhaven College of the Dallas County Community District is conducting a needs survey to determine the feasibility of developing two new "Environmental" curricula by the 1995 spring semester. The programs will include both a two-year Associate Degree in Applied Science and a one-year Certificate of Completion Program. Persons trained in either of these technical disciplines will have the essential skills and knowledge to work in rapidly expanding environmental career fields as Environmental Technicians.

Our research indicates that career opportunities within environmental technology will only continue to expand. In September, 1989, the Texas Innovation Information Network System (TIINS) identified "Environmental Laboratory Technician" as an emerging occupation with a projected need of 51 - 100 jobs in 1995. However, in a later study, the 1993, the Quality Work Force Council for North Central Texas (INTERLINK) projected 201 to 5000 jobs by 2000. The Environmental Protection Agency estimated that the United States needed 100,000 professionals to manage the nation's hazardous waste materials problems, but at the time of the article, only 50,000 such professionals were available. (Dallas Times Herald, July 1991) According to Texas Business Today, February 1993, at the "Federal level alone, more than 20 major environmental acts and dozens of executive orders and rulings now affect Texas companies." A review of the data strongly suggests that there is a need for programs that will produce qualified professionals in environmental technology.

However, our exploration will be incomplete without your assistance. For this reason, Brookhaven College seeks your help and asks that you to take a few moments to complete the enclosed questionnaire. **Your participation in this survey is very important**. Please respond by Monday, May 2nd using the enclosed self-addressed envelope or FAX the three pages of the survey to Linda Lee (FAX # 214-620-4897). A fax cover page will not be needed.

It is our goal to complete this needs study/questionnaire and analysis during May 1994. If the response from you and others continues to be as positive as is anticipated, Brookhaven College will petition the Texas Higher Education Coordinating Board for approval to offer a new technical occupation program in Environmental Technology. Should you have any questions, please feel free to contact me at 214-620-4851.

Thank you.

Sincerely,

Linda Lee

Linda Lee
Director, Instructional Development

ALL three pages of this survey can be faxed as is to:
FAX # (214) 620-4897

Ms. Linda Lee
Director of Instructional Development
Brookhaven College

Brookhaven College
Employer Needs Assessment
for Environmental Technician

> *One who conducts field and laboratory tests, gathers and processes data for use by engineering, regulatory, and scientific personnel in: 1) determining sources and methods of controlling contaminants, pollutants and harmful or hazardous materials in the soil, air, water. 2) analyzing any product which includes but is not limited to pharmaceuticals, cosmetics, foods and agriculturals which may impact on health and the environment.*
> *(Source: DACUM Panel, November 4, 5, 1993)*

Brookhaven College wishes to thank you in advance for your time and thoughtful input in completing this **Employer Needs Assessment**. Your answers may well determine the future development of the proposed programs.

Please note that where there are two answer columns - one is for the two year program, the Associate Degree in Applied Science - and the second is for the one year program, the Certificate.

	AAS Degree (2 years)	Certificate (1 year)
1. Do you agree that there is a distinct need at this time for the proposed training?	_____ YES _____ NO	_____ YES _____ NO
2. If yes (to # 1) please rate this need on a scale of 4 to 1 with 4 representing a great **need for the program** and 1 **no need for the program. Please** circle the most appropriate number.	1 2 3 4	1 2 3 4
3. Would you support/encourage your staff to enroll in these programs?	YES _____ NO _____	YES _____ NO _____

4. Does your company CURRENTLY employ anyone who performs the types of duties described in the boxed segment above?
A. Yes _____ B. No _____

5. If "yes" (to #4) what is this worker's position title?

____

6. If "yes" (to #4) how many of these workers are employed by your company? _____

7. If a pool of qualified workers was available, skilled in environmental technology, and they possessed either a one year Certificate or an Associates in Applied Science Degree, how many would you consider hiring in the next 1, 2, 3, 4, 5 years?

A. Person(s) with a Certificate
Part time hires: 1 year ______ 2 years _____ 3 years ______ 4 years ______ 5 years _______

Full time hires: 1 year ______ 2 years _____ 3 years ______ 4 years ______ 5 years _______

B. Person(s) with an Associates Degree
Part time hires: 1 year ______ 2 years _____ 3 years ______ 4 years ______ 5 years _______

Full time hires: 1 year ______ 2 years _____ 3 years ______ 4 years ______ 5 years _______

8. If "yes" (to #4), what is the entry level of education you require for this employee? Please check all that apply.
_____ High School
_____ On the job training
_____ One year Certificate (community college)
_____ Two year Associates Degree (community college)
_____ Four year Degree (college/university)
_____ Other: ____

9. What pay range would you anticipate for someone with a one or two year degree? Please select one range for the certificate and one for the degree.
Certificate : Hourly $ ____________
Per Week $ ____________
Annual $ ____________

Associates of Applied Science Degree:
Hourly $ ____________
Per Week $ ____________
Annual $ ____________

10. Total number of people employed by your company?
______less than 25, please indicate the number of employees ______
______between 25 and 50
______between 51 and 100
______between 101 and 500
______over 501

11. Would you be interested in knowing more about this program if it is approved for implementation by the Texas Higher Education Coordinating Board? Yes ______ No _______ (If yes, please provide mailing information.).

12. Would you be interested in offering your facilities for on-site student visits?
Yes _____ No _____

13. Would your company consider providing cooperative education experiences for students working toward a degree in this occupational program?
Yes _____ No _____

14. Would you like to work with Brookhaven College as an advisor to this program, if it is approved?
Yes _____ No _____

15. Please add any additional comments, suggestions, or remarks in the space below.

THANK YOU for contributing your time and experience to assist us in this project. Please provide the following information in order that we may have a record of responses returned. Your response will be kept confidential and only group data will be reported.

Name of your company:

Products; services:

Address:

Telephone #: FAX #:

Contact person:

Thank you again for your cooperation.

Educational opportunities are offered by the Dallas County Community College District without regard to race, color, age, national origin, religion sex or handicap.

Brookhaven College

ENVIRONMENTAL TECHNOLOGY

Student Interest Survey

Brookhaven College is currently developing a new program in Environmental Technology:

> *An* ***environmental technician*** *conducts tests and field investigations to obtain data for use by environmental engineering and scientific personnel in determining sources and methods of controlling pollutants and harmful or hazardous materials in soil, air (indoor or outdoor), water (for consumption or in the outdoors), and in any product which may impact on personal health; and conducts tests within industrial facilities for protection of employee and/or the public.*

The program will offer a one-year certificate (Laboratory/Field Assistant) and a two-year Associate in Applied Science (Environmental Technician). Both programs will provide graduates with technical skills for career opportunities in the environmental work force. Also, if you're thinking of transferring to a four-year college or university, a number of courses in this AAS curriculum will transfer.

Did you know that environmental careers can be found in the following technical fields?

LIFE SCIENCES agricultural and biological science, biochemistry, botany, microbiology, ecology

PHYSICAL SCIENCES chemistry, earth science, physics, computer science

MINING AND MINERAL EXTRACTION

ENGINEERING AND TECHNOLOGY aerospace, architecture, chemical engineering, civil engineering, electronics, manufacturing, petroleum engineering

OIL AND GAS EXPLORATION AND PRODUCTION

Did you know that environmental careers are available in the following non-technical areas?

accounting, agribusiness, business management, city, urban, and regional planning, communications, criminal justice, economics, education, geography, history, home economics, law, liberal arts, parks and recreation, political science

Did you know that the entering employment wages paid for an Environmental Technician (AAS) range from 8.65 to 12.00/hour? An experienced Environmental Technician can earn up to $17.00/hour.

Now that you know a little more about different kinds of environmental careers, does this sound like a career path you might be interested in?

YES_______ NO_______

Would you be interested in exploring or studying Environmental Technology at Brookhaven College?

YES_______ NO_______

If you have more questions about this program or would like more information on occupations in Environmental Technology, please call Linda Lee at 620-4855. Thank you for your help.

Brookhaven College
ENVIRONMENTAL TECHNOLOGY
Student Interest Survey

Brookhaven College is currently developing a new program in Environmental Technology:

> *An* ***environmental technician*** *conducts tests and field investigations to obtain data for use by environmental engineering and scientific personnel in determining sources and methods of controlling pollutants and harmful or hazardous materials in soil, air (indoor or outdoor), water (for consumption or in the outdoors), and in any product which may impact on personal health; and conducts tests within industrial facilities for protection of employee and/or the public.*

The program will offer a one-year certificate (Laboratory/Field Assistant) and a two-year Associate in Applied Science (Environmental Technician). Both programs will provide graduates with technical skills for career opportunities in the environmental work force. Also, if you're thinking of transferring to a four-year college or university, a number of courses in this AAS curriculum will transfer.

Did you know that environmental careers can be found in the following technical fields?
LIFE SCIENCES agricultural and biological science, biochemistry, botany, microbiology, ecology

PHYSICAL SCIENCES chemistry, earth science, physics, computer science

MINING AND MINERAL EXTRACTION

ENGINEERING AND TECHNOLOGY aerospace, architecture, chemical engineering, civil engineering, electronics, manufacturing, petroleum engineering

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Did you know that the entering employment wages paid for an Environmental Technician (AAS) range from 8.65 to 12.00/hour? An experienced Environmental Technician can earn up to $17.00/hour.

Now that you know a little more about different kinds of environmental careers, does this sound like a career path you might be interested in?

YES 40% (21/52) NO 60% (31/52)

Would you be interested in exploring or studying Environmental Technology at Brookhaven College?

YES 31% (16/52) NO 69% (36/52)

If you have more questions about this program or would like more information on occupations in Environmental Technology, please call Linda Lee at 620-4855. Thank you for your help.

ENVIRONMENTAL TECHNOLOGY

DACUM Validation

	Priority of Task							Frequency of Task Performance								
	Essential	Very Important	Important	Moderately important	Not Important	Don't Know		Daily	Weekly	Monthly	Quarterly	Yearly	Don't Know		Expected to know when hired	Can learn on the job

Please do not separate this page

INSTRUCTIONS

There are three categories in which to classify each task: priority of task, frequency of task performance, and skill expectations for newly hired technicians.
Classifications within each category are discussed below:

PRIORITY OF TASK: one way to appraise task priority is by asking yourself, "What would be the result of omitting this task during performance of this duty?"

For example, if an *essential* task is omitted, no further activity is possible in the performance of that duty.

Omission of a *very important* task would not halt activity but information subsequently obtained would not be considered reliable.

Omission of a *moderately important* task would not halt activity but would cause careful inspection of any information subsequently obtained.

Omission of an *important* task would not halt activity nor affect reliability of subsequent information on a one-time basis; however, frequent omission would cause information obtained from subsequent performance of that duty to deteriorate in quality.

Omission of a *not important* task would not affect activity nor reliability of information.

If you are not familiar with a certain task, please check *Don't know*.

FREQUENCY OF TASK: Each task is not performed every time the duty is performed. *Task frequency* is the time interval at which it would be necessary to maintain quality of duty performance.

For example, an instrument might be used *daily*, but a calibration check would be necessary only *weekly*.

If you are not familiar with a certain task, please check *Don't know*.

SKILL EXPECTATIONS FOR NEWLY HIRED TECHNICIANS:
The last two columns refer to the expectations of an employer hiring a technician. If the task is something you would expect a newly hired employee to walk in and perform immediately, with only time allowed for adjustment to a new environment, check *Expected to know when hired*. If the task is something you would not expect a newly hired employee to perform immediately, but you would expect he or she to be able to learn that task within a reasonable amount of time, check *Can learn on the job*.

THANK YOU!

for contributing your time and experience to assist us in this project. Please give your name and address in the space below in order that we may have a record of responses returned and persons surveyed; your response will be kept confidential and only group responses will be reported.

Name____

Company______________________________________

Position______________________________________

Address______________________________________

City________________State__________Zip__________

Field/Laboratory Technician Validation Chart

Check ONE in each category	Priority of Task							Frequency of Task Performance								
	Essential	Very Important	Important	Moderately Important	Not Important	Don't Know		Daily	Weekly	Monthly	Quarterly	Yearly	Don't Know		Expected to know when hired	Can learn on the job
A Practice Safety																
A-1 Follow OSHA lab/field personnel guidelines																
A-2 Follow company safety policies																
A-3 Observe MSDS information																
A-4 Observe warning labels																
A-5 Wear personal protective equipment																
A-6 Work under hood																
A-7 Store compressed gases and chemicals																
B Keep Records																
B-1 Keep lab/field notebooks																
B-2 Document sampling procedures																
B-3 Maintain chain of custody records																
B-4 Document sample preparation procedures																
B-5 Keep standards/reagents log																
B-6 Keep instrument run log																
B-7 Keep maintenance log																
B-8 Keep telephone logs																
B-9 Keep inventory records																
B-10 Archive records																
C Maintain Equipment																
C-1 Order equipment and supplies																
C-2 Conduct performance checks																
C-3 Calibrate instruments																
C-4 Clean equipment																
C-5 Check personal protective gear																
C-6 Change fluids																
C-7 Add gas																
C-8 Follow manufacturer's recommended maintenance schedules																
C-9 Replace worn parts																

ENVIRONMENTAL
TECHNOLOGY

SAMPLE

DACUM Validation

	Priority of Task							Frequency of Task Performance								
	Essential	Very Important	Important	Moderately important	Not Important	Don't Know		Daily	Weekly	Monthly	Quarterly	Yearly	Don't Know		Expected to know when hired	Can learn on the job
A Practice Safety																
A-1 Follow OSHA lab/field personnel guidelines	58	15	18	1	1	1		89	1	0	1	0	3		19	72
A-2 Follow company safety policies	68	22	6	1	0	0		93	1	1	0	0	0		8	88
A-3 Observe MSDS information	47	22	18	4	1	4		67	11	3	1	0	8		29	64
A-4 Observe warning labels	67	19	11	1	0	0		86	1	0	0	0	3		67	29
A-5 Wear personal protective equipment	69	14	14	1	0	0		81	4	1	0	0	4		53	40
A-6 Work under hood	50	18	22	6	0	3		75	4	4	0	0	6		67	29
A-7 Store compressed gases and chemicals	49	24	21	6	0	0		58	15	7	0	0	6		44	50
B Keep Records																
B-1 Keep lab/field notebooks	63	25	10	1	1	0		85	3	0	0	0	1		65	29
B-2 Document sampling procedures	43	24	17	11	3	1		65	7	4	3	0	8		43	51
B-3 Maintain chain of custody records	44	18	15	11	1	7		57	10	4	1	0	18		32	60
B-4 Document sample preparation procedures	40	28	17	13	0	1		67	10	4	3	0	8		49	47
B-5 Keep standards/reagents log	28	31	19	14	3	3		39	29	7	1	0	11		31	63
B-6 Keep instrument run log	26	26	28	15	1	3		51	24	7	0	0	7		31	65
B-7 Keep maintenance log	22	22	32	19	3	1		29	28	21	0	1	8		25	72
B-8 Keep telephone logs	11	14	19	18	24	14		42	15	10	1	1	19		14	78
B-9 Keep inventory records	17	13	32	24	10	3		18	22	25	6	7	10		13	83
B-10 Archive records	19	7	31	28	8	6		8	11	33	10	13	14		8	86
C Maintain Equipment																
C-1 Order equipment and supplies	6	21	40	15	13	4		3	29	33	4	4	7		18	74
C-2 Conduct performance checks	14	33	29	14	1	7		24	35	13	1	1	10		24	64
C-3 Calibrate instruments	43	33	11	6	1	4		38	22	11	3	1	8		35	54
C-4 Clean equipment	31	29	21	14	0	1		49	22	8	0	0	4		44	50
C-5 Check personal protective gear	38	31	17	11	0	3		47	18	8	3	0	7		42	51
C-6 Change fluids	11	18	25	15	1	22		13	24	8	6	0	31		14	67
C-7 Add gas	10	17	18	14	1	32		10	22	4	4	0	39		13	65
C-8 Follow manufacturer's recommended maintenance schedules	18	26	38	15	0	1		17	13	31	8	3	11		14	82
C-9 Replace worn parts	15	24	25	19	7	6		10	14	22	14	4	15		14	76

SAMPLE
Validation Chart

JOB TITLE:

JOB DESCRIPTION:

	Importance of Task				Frequency of Task Performance				Performance Level Needed				Entry Level		
	Column 1				Column 2				Column 3				Column 4		
CATEGORY A:	Essential	Important	Not Important	Don't Know	Frequency	Sometimes	Never	Don't Know	Awareness	Understanding	Application	Don't Know	Yes	No	Don't Know

Source: Adapted from Career and Continuing Education form, DCCCD

SAMPLE
Validation

JOB TITLE Air Conditioning Technician

JOB DESCRIPTION The Air Conditioning/Refrigeration Technician will install, service, maintain, diagnose, and repair air conditioning/refrigeration systems.

	Importance of Task				Frequency of Task Performance				Performance Level Needed				Entry Level		
	Column 1				Column 2				Column 3				Column 4		
CATEGORY A: Display Professional Behavior	Essential	Important	Not Important	Don't Know	Frequency	Sometimes	Never	Don't Know	Awareness	Understanding	Application	Don't Know	Yes	No	Don't Know
1. Prioritize responsibilities															
2. Respect customers' property and values															
3. Cooperate with peers															
4. Maintain grooming habits															
5. Display punctuality															
6. Perform work in a timely manner															
7. Keep vehicle clean															
8. Organize tools															
9. Attend seminars															
10. Consult with readers															
11. Read trade publications															

Source: Adapted from Career and Continuing Education form, DCCCD

CROSSWALK

ENVIRONMENTAL TECHNOLOGY

SAMPLE

CROSSWALK FROM DACUM

	General Chemistry 101/102	Intro to ENVT	Sampling and Field Testing	Hazardous Materials	Quantitative Analysis	Instrumental Analysis	Advanced Instrumentation	Biochemical Processes	ENVT II	Environmental Calculations	Industrial Processes
A Practice Safety											
A-1 Follow OSHA lab/field personnel guidelines	C1	P2	P3	C3	C2	C2	C3	C2			C2
A-2 Follow company safety policies		C2			C2	C2	C3	C2			C3
A-3 Observe MSDS information	C1	C2	C2	A2	C2	C2	C3	C2			C3
A-4 Observe warning labels	C1	C1	C2		C2	C2	C3	C2			
A-5 Wear personal protective equipment	P1	C2	P2	C3	C2	C2	C3	C2			
A-6 Work under hood	P1	C2	P2	C2	C2	C2	C3	C2			
A-7 Store compressed gases and chemicals	C1	C1	P2	C3	C2	C2	C3	C2			
B Keep Records											
B-1 Keep lab/field notebooks	P1		P2	C2	P2	P2	P3	P2	C2		C3
B-2 Document sampling procedures			P2	C2	P2	P2	P3	P2	C2		C3
B-3 Maintain chain of custody records			P2	C2	P2	P2	P3	P2	C2		C3
B-4 Document sample preparation procedures	P1		P2	C2	P2	P2	P3	P2	C2		C3
B-5 Keep standards/reagents log			P2	C2	P2	P2	P3	P2	C2		C3
B-6 Keep instrument run log			P2	C2	P2	P2	P3	P2	C2		C3
B-7 Keep maintenance log			P1	C2	P2	P2	P3	P2	C2		C3
B-8 Keep telephone logs				C2			P3		C2		C3
B-9 Keep inventory records				C2			P3		C2		C3
B-10 Archive records				C2			P3		C2		C3
C Maintain Equipment											
C-1 Order equipment and supplies							P3				C2
C-2 Conduct performance checks			P2	C2	P1	P2	P3	P2			C2
C-3 Calibrate instruments	C1		P2		P1	P2	P3	P2			C2
C-4 Clean equipment			P2		P1	P2	P3	P2			C2
C-5 Check personal protective gear			P2	C2	P1	P2	P3	P2			C2
C-6 Change fluids						P1	P3				C2
C-7 Add gas						P1	P3				C2
C-8 Follow manufacturer's recommended maintenance schedules						P1	P3				C2
C-9 Replace worn parts						P1	P3				C2

SAMPLE
Crosswalk Chart

JOB TITLE:

JOB DESCRIPTION:

	COURSE NUMBERS												
CATEGORY:													

*entry level task

COGNITIVE	PSYCHOMOTOR	AFFECTIVE
C1 Fact	P1 Imitation	A1 Awareness
C2 Understanding	P2 Practice	A2 Distinguish
C3 Applications	P3 Habit	A3 Integrate

Source: Adapted from Career and Continuing Education form, DCCCD

SAMPLE
Crosswalk Chart

JOB TITLE Air Conditioning Technician

JOB DESCRIPTION The Air Conditioning/Refrigeration Technician will install, service, maintain, diagnose, and repair air conditioning/refrigeration systems.

	COURSE NUMBERS												
	ACR 109	ACR 110	ACR 111	ACR 112	ACR 113	ACR 114	ACR 115	ACR 116	ACR 117	ACR 120	ACR 125	ACR 130	
CATEGORY B Document Work													
1. Record customer information*													
2. Record service request*													
3. Record equipment information*													
4. Describe service performed*													
5. Itemize parts on invoice*													
6. Explain warranty terms*													
7. Explain invoice*													
8. Verify acceptance with customer's signature*													

*entry level task

COGNITIVE	PSYCHOMOTOR	AFFECTIVE
C1 Fact	P1 Imitation	A1 Awareness
C2 Understanding	P2 Practice	A2 Distinguish
C3 Applications	P3 Habit	A3 Integrate

Source: Adapted from Career and Continuing Education form, DCCCD

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Decision Rules

The following are the decision-making rules for cross-walking business/industry data into the curriculum via the curriculum validation:

Question	Business/Industry Response	Curriculum Response
1. Frequency	Frequency	High
	Sometimes	Low
2. Difficulty	50% ≥ Competent plus highly proficient	High
	50% ≥ Extremely limited or partially proficient	Low
3. Purpose	Essential	Crucial
	Important	Foundation
4. Performance Level		Cognitive, Psychomotor or Affective by definition■
	Extremely limited/partially proficient	LEVEL 1
	Competent	LEVEL 2
	Highly proficient	LEVEL 3

■ DEFINITIONS:	
Cognitive (knowledge):	
1. Fact	■ Focus on a single concept.
2. Understanding	■ Put two or more concepts together.
3. Application	■ Put two or more concepts together to form something new.
Psychomotor (skill):	
1. Imitation	■ Repeat a task demonstration under instructor's supervision.
2. Practice	■ Build task proficiency without instructor's direct supervision.
3. Habit	■ Perform a task in maximally twice the tie it takes the instructor to perform the same task.
Affective (behavior reflecting beliefs):	
1. Awareness	■ Respond with passive compliance to stated expectations.
2. Distinction	■ Display unforced compliance consistent with a single belief or attitude.
3. Integration	■ Display total behavior consistent with internalized set of values and beliefs.

Source: Adapted from Career and Continuing Education form, DCCCD

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TRAINING ACHIEVEMENT RECORD

General Employability Traits		
Factors	**Scale Value**	**Definition**
PSYCHOMOTOR **PERFORMANCE LEVEL**	1	**EXTREMELY LIMITED**: Can do simple parts of task. Needs to be told/shown how to do most of task. needs extremely close supervision.
	2	**PARTIALLY PROFICIENT**: Can do most parts of task. Needs help only on hardest parts. May not meet local demands for speed and accuracy. Needs close supervision.
	3	**COMPETENT**: Can do all parts of task. Needs only spot check of completed work. Meets minimum local demands for speed and accuracy. Needs job entry supervision.
	4	**HIGHLY PROFICIENT**: Can complete task quickly and accurately. Can direct others in how to do the task. Needs normal supervision.
COGNITIVE **KNOWLEDGE LEVEL**	a	**NOMENCLATURE**: Can identify parts, tools, and understand simple facts about the task. can identify related basic facts and terms.
	b	**PROCEDURES**: Can name most steps in doing task. Needs help interpreting written instructions. Can explain basic facts and state general principles.
	c	**TECHNIQUES AND PRINCIPLES**: Can explain how and when task must be done; why each step is needed. Can interpret written and oral instructions. Can analyze facts/principles.
	d	**OPERATING PROFICIENCY**: Identify, measure, and use trouble shooting techniques resolving task related problems. Can evaluate conditions and make proper decisions.
AFFECTIVE: **PERSONAL BEHAVIOR LEVEL**	I	**OCCASIONALLY** reliable, cooperative, responsible, interested, respectful, and satisfactory personal appearance.
	II	**USUALLY** reliable, cooperative, responsible, respectful and appropriate personal appearance.
	III	**CONSISTENTLY** reliable, cooperative, responsible, interested, respectful and appropriate personal appearance.
	IV	**EXCEPTIONALLY** reliable, cooperative, responsible, interested, respectful and appropriate personal appearance, demonstrates self assurance.

Source: Adapted from Career and Continuing Education form, DCCCD

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APPENDIX K

VERIFICATION INSTRUMENTS AND SAMPLE COVER LETTERS

INDUSTRIAL MECHANICS TECHNOLOGY DACUM VERIFICATION SURVEY

On March 2-3, 1982, a DACUM was conducted at Trident Technical College for the Industrial Mechanics Technology program involving representation of ten local industries. From the panel's input, a draft DACUM chart was prepared, and a verification survey based on the identified competencies was developed and sent to twenty-six persons identified either as incumbent industrial mechanics or supervisors of industrial mechanics, including the original ten DACUM participants. (The firms participating in the verification process are identified in appendix 2.) Twenty-one responses were received and are included in the data tabulation.

Data from the survey is presented by mean response to each question and by number of respondents to each category of each question (appendix 1.)

Trident Technical College is committed to develop individualized competency-based instruction that will assist learners to achieve competence through effective training. With the input of expert practitioners and supervisors to identify those tasks which are most important and which truly make a difference for entering workers, this survey data can provide a sound basis for decision making in program and learning material development.

Source: *DACUM Handbook*, Center for Education and Training for Employment, the Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 (614-292-4353)

TRIDENT TECHNICAL COLLEGE

Survey Number________

1982 Industrial Mechanics Survey

The purpose of this survey is to identify the most important tasks Industrial Mechanics in the Trident area perform. This information will help define the skills an Industrial Mechanics graduate needs which will be used to develop the curriculum for the new Industrial Mechanics program. Please read the directions carefully and answer every question.

Instructions:

The questionnaire contains a list of tasks divided into 12 major groups (A through L) which relate to the occupation of Industrial Mechanic. We need your response to three major questions about each task:

1. How important is the performance of the task in the job of an Industrial Mechanic?
2. How frequently do you perform the task? (or how frequently do those Industrial Mechanics whom you supervise perform the task?)
3. Is the task expected of a beginning Industrial Mechanic?

Answer these questions by completing the following steps:

1. For each task rate the importance of the performance of that task to the job of the Industrial Mechanic by circling one response under column 1.
2. For each task indicate how often the task is performed by circling one response under column 2.
3. For each task indicate if this task would be expected to be performed by a beginning Industrial Mechanic by circling one response in column 3.

Be sure to circle one response under each column for every task.

Please feel free to add any additional tasks or general comments.

Source: *DACUM Handbook*, Center for Education and Training for Employment, the Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 (614-292-4353)

MEAN RESPONSE
N=21

Task Statements	Importance of Task Column 1 Essential 3 · Imp. 2 · Not Imp. 1 · Don't know 0	Frequency of Performance of Task Column 2 Frequently 3 · Sometimes 2 · Never 1 · Don't know 0	Entry Level Column 3 Yes 2 · No 1 · Don't know 0
Category A: Use Hand and Power Tools			
1. Select proper tools	2.85	3.00	1.90
2. Use tools safely	2.90	2.95	1.90
3. Use basic hand tools	2.90	2.95	1.95
4. Operate hand power tools	2.42	2.71	1.90
5. Maintain tools	2.60	2.66	1.66
6. Use precision hand tools	2.23	2.26	1.47
7. Use precision measuring instruments	2.25	2.30	1.57
8. Operate general machine shop equipment	2.15	2.30	1.47
9. Use diagnostic equipment	1.90	2.05	1.04
Category B: Repair Equipment			
1. Use maintenance manuals	2.71	2.57	1.85
2. Use trouble shooting techniques	2.71	2.66	1.60
3. Use proper fastening techniques	2.28	2.52	1.77
4. Analyze cause of breakdown	2.38	2.52	1.52
5. Prepare parts list including specifications	1.90	2.07	1.37
6. Replace bearings	2.71	2.85	1.80
7. Repair/replace mechanical seals	2.57	2.61	1.61
8. Repair pumps	2.42	2.52	1.61
9. Repair compressors	2.23	2.23	1.19
10. Repair power transmission equipment	2.19	2.38	1.52

Source: *DACUM Handbook*, Center for Education and Training for Employment, the Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 (614-292-4353)

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Task Statements	Importance of Task Column 1 Essential 3	Imp. 2	Not Imp. 1	Don't know 0	Frequency of Performance of Task Column 2 Frequently 3	Sometimes 2	Never 1	Don't know 0	Entry Lev Column 3 Yes 2	No 1	't know 0
Category A: Use Hand and Power Tools											
1. Select proper tools	18	[illegible]	0	0	21	0	0	0	18	2	0
2. Use tools safely	19	2	0	0	20	1	0	0	19	2	0
3. Use basic hand tools	19	[illegible]	0	0	20	1	0	0	20	1	
4. Operate hand power tools	13	8	0	0	17	4	0	0	19	2	0
5. Maintain tools	13	6	1	0	14	7	0	0	14	7	
6. Use precision hand tools	7	12	2	0	6	14	0	0	9	10	
7. Use precision measuring instruments	6	13	1	0	6	14	0	0	12	9	
8. Operate general machine shop equipment	5	13	2	0	6	14	0	0	10	11	0
9. Use diagnostic equipment	1	16	3	0	1	19	0	0	1	20	[illegible]
Category B: Repair Equipment											
1. Use maintenance manuals	15	6	0	0	12	9	0	0	17	3	
2. Use trouble shooting techniques	15	6	0	0	14	7	0	0	13	6	
3. Use proper fastening techniques	9	11	1	0	12	8	1	0	14	4	
4. Analyze cause of breakdown	9	[illegible]	1	0	11	10	0	0	10	9	
5. Prepare parts list including specifications	3	13	5	0	4	14	2	0	7	12	[illegible]
6. Replace bearings	15	[illegible]	0	0	18	3	0	0	17	4	
7. Repair/replace mechanical seals	12	[illegible]	0	0	13	8	0	0	13	8	[illegible]
8. Repair pumps	10	10	1	0	11	10	1	0	13	8	[illegible]
9. Repair compressors	7	12	2	0	6	14	1	0	5	15	[illegible]
10. Repair power transmission equipment	8	9	4	0	9	11	0	0	11	10	[illegible]

Source: *DACUM Handbook*, Center for Education and Training for Employment, the Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 (614-292-4353)

BARBER JOB/TASK ANALYSIS AND LETTERS

The National Association of
Boards of Barber Examiners
of America

BARBER JOB/TASK ANALYSIS

Why We Need YOUR Help

The National Association of Boards of Barber Examiners of America is conducting a national study to determine the tasks performed by barbers to effectively carry out their duties and responsibilities.

The study requires the careful identification and verification of the many tasks performed by barbers on a national level. Once the tasks have been identified, we will have a better basis for developing fair and valid barber examinations. The knowledge and experience you have gained by your direct involvement in most, if not all, of these tasks make you uniquely qualified to advise us on the importance, frequency and criticality of each task. Your individual responses will be held in strict confidence, as only group responses will be reported.

You have been carefully selected as a qualified respondent, and your input will contribute to the development of a valid examination for barbers.

Please complete this analysis within five working days. Return the completed survey to the person distributing the survey or place it in the stamped and addressed envelope that has been provided. As a small expression of our appreciation for completing this analysis, we will send you a summary of our findings.

THANKS VERY MUCH FOR YOUR ASSISTANCE.

Source: *DACUM Handbook*, Center for Education and Training for Employment, the Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 (614-292-4353)

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PART I - TASK STATEMENTS

Instructions: Please read very carefully!

On the pages which follow you will find a list of task statements clustered into 23 major categories (A through P) which relate to the occupation of barbering
We need your personal reaction to three major questions about each task statement:

a. How important is the performance of the task in your job as a barber?

b. How frequently do you perform the task?

c. How critical is the task?

Answer these questions by completing the following steps:

1. For each task in Categories A through P indicate how important you believe performance of the task is in your job as a barber. In the "Importance of Tas column choose and circle the number which most accurately reflects the importance of that task. If you do not perform some of the tasks, please circle th number which indicates how important you believe those tasks are to the overall occupation of barbering. Use the scale below to rate the importance of each task:

5 = Of Great Importance	Performance is important to the occupation of barbering.
4	
3	
2	
1	
0 = Of No Importance	Performance makes no contribution to the occupation of barbering.

2. For each of the tasks in Categories A through P (except those you judged to be of no importance), indicate the frequency of performance. Use the scale be to indicate the frequency of the task:

5 = Frequently Performed	The task is frequently performed.
4	
3	
2	
1	
0 = Never Performed	The task is never performed.

3. For each of the tasks in Categories A through P, indicate the criticality of the task by determining its importance when performed on the consumer. Use the scale below to indicate the criticality:

5 = Very Critical	The task is critical to the consumer if not performed properly.
4	
3	
2	
1	
0 = Not Critical	The task is not critical to the consumer.

4. Repeat Steps No. 1, No. 2 and No. 3 for each of the categories.

5. Add any statements to Categories A through P that describe other tasks that you have performed or that you feel need to be performed by barbers which are not listed.

6. Check the inventory to see if you have responded to all questions for each statement (except for those tasks which you judged to be of no importance).

Source: *DACUM Handbook*, Center for Education and Training for Employment, the Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 (614-292-4353)

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BARBER JOB/TASK ANALYSIS

NOTE: PLEASE BE SURE YOU HAVE READ THE ABOVE INSTRUCTIONS CAREFULLY BEFORE PROCEEDING.

Task Statements	No. 1 Importance of Task How important is the performance of this task in your job as a barber? (Circle one response)	No. 2 Frequency of Performance How frequently do you perform this task? (Circle one response)	No. 3 Criticality How critical is the performance of this task to the consumer? (Circle one response)
CATEGORY A: Perform Haircuts	Great Importance — No Importance	Frequently Performed — Never Performed	Critical — Not Critical
1. Comply with required sanitary procedures	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
2. Protect patron	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
3. Consult with patron	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
4. Prepare the patron	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
5. Cut the hair with clippers, shears or razor	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
6. Taper the hair with clippers, shears or razor	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
7. Layer the hair with clippers, shears or razor	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
8. Thin the hair with thinning shears, shears or razor	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
9. Outline the hair with clippers, shears or razor	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
10. Clean (edge) the neck with clippers or razor	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
11. Perform children's haircuts	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
12. Perform ladies' haircuts	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
13. Perform men's haircuts	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
14. Dress the hair	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
CATEGORY B: Perform Hairstyling			
1. Comply with required sanitary procedures	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
2. Protect patron	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
3. Consult with patron	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0

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Task Statements	No. 1 Importance of Task How important is the performance of this task in your job as a barber? (Circle one response)	No. 2 Frequency of Performance How frequently do you perform this task? (Circle one response)	No. 3 Criticality How critical is the performance of this task to the consumer? (Circle one response)
	Great Importance … No Importance	Frequently Performed … Never Performed	Critical … Not Critical
CATEGORY N: Comply With Laws and Rules			
1. Obtain knowledge of federal and state laws and rules	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
2. Implement appropriate laws and rules	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
3. Maintain communications with the Barber Board	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
CATEGORY O: Maintain Patron Records			
1. Establish patron profile	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
2. Maintain patron profile	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
3. Prepare product sales record	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
4. Prepare and maintain patron service record	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
5. Maintain periodic patron communications	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
CATEGORY P: Continue Education			
1. Attend seminars and workshops	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
2. Participate in professional training courses	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
3. Subscribe to and read professional and trade journals	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
4. Participate in professional organizations	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0
5. Apply acquired knowledge	5 4 3 2 1 0	5 4 3 2 1 0	5 4 3 2 1 0

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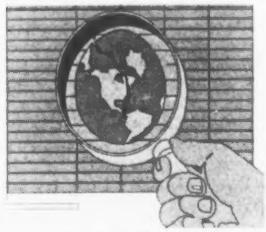

SCANS/ WORKPLACE COMPETENCIES

ASSESSMENT AND EVALUATION OF WORK PLACE COMPETENCIES AND FOUNDATION SKILLS

Active incorporation of SCANS competencies and foundation skills into course activities has been a major thrust of educators in the past several years. Nowhere is it more important for workplace competencies to be covered actively than in a technology centered program. The proposed Environmental Technology program has the following components, with examples of each included for your use:

1. SCANS foundation skills and workplace competencies evaluation forms.

2. Industry standard for competency level for student graduating from the Environmental Technology program: This standard was developed by the local technical advisory committee for the program at Brookhaven.

3. Incorporation of SCANS competencies into curriculum plan: Activities teaching SCANS competencies were developed for each course. An example for the Advanced Instrumentation course is shown.

4. Individual student assessment and evaluations: A SCANS check sheet for each course is completed by the instructor for each student, using the industry standard mentioned above. These become part of the student's permanent record.

5. Degree plans: A degree plan incorporating the SCANS check has been developed for each program options (AAS, certificate, Advanced Skills certificates).

SCANS
Occupational Assessment
WorkPlace Know-How

The know-how identified by SCANS is made up of five competencies and a three-part foundation of skills and personal qualities needed for solid job performance. The rating level ranges from a 1 (low) to 5 (high). Please circle your response.

Competencies	**Rating Scale**				
	Low			**High**	
Resources: Identifies, organizes, plans and allocates resources.					
C1 Time-selects goal-relevant activities, ranks them, allocates time, and prepares and follows schedules.	1	2	3	4	5
C2 Money-Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives.	1	2	3	4	5
C3 Materials and Facilities-Acquires, stores, allocates, and uses materials or space efficiently.	1	2	3	4	5
C4 Human Resources-Assesses skills and distributes work accordingly, evaluates performance and provides feedback.	1	2	3	4	5
Information: Acquires and uses information.					
C5 Acquires and Evaluates Information	1	2	3	4	5
C6 Organizes and Maintains Information	1	2	3	4	5
C7 Interprets and Communications Information	1	2	3	4	5
C8 Uses Computers to Process Information	1	2	3	4	5
Interpersonal: Works with others.					
C9 Participates as Members of a Team-Contributes to group efforts.	1	2	3	4	5
C10 Teaches Others New Skills	1	2	3	4	5
C11 Serves client/Customers-Works to satisfy customer's expectations.	1	2	3	4	5
C12 Exercises Leadership-Communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies.	1	2	3	4	5
C13 Negotiates-Works toward agreements involving exchange of resources, resolves divergent interests.	1	2	3	4	5
C14 Works with Diversity-Works well with men and women from diverse backgrounds.	1	2	3	4	5
Systems: Understands complex Interrelationships.					
C15 Understands Systems-Knows how social, organizational, and technological systems work and operates effectively with them.	1	2	3	4	5
C16 Monitors and Corrects Performance-Distinguishes trends, predicts impacts on system operations, diagnoses systems' performance and corrects malfunctions.	1	2	3	4	5
C17 Improves or Designs Systems-Suggests modifications to existing systems and develops new or alternative systems to improve performance.	1	2	3	4	5
Technology: Works with a variety of technologies.					
C18 Selects Technology-Chooses procedures, tools or equipment including computers and related technologies.	1	2	3	4	5
C19 Applies Technology to Task-Understands overall intent and proper procedures for setup and operation of equipment.	1	2	3	4	5
C20 Maintains and Troubleshoots Equipment-Prevents, identifies, or solves problems with equipment, including computers and other technologies.	1	2	3	4	5

SCANS
Foundation Skills

A Three-Part Foundation					
Foundation	**Rating Scale**				
	Low			**High**	
Basic Skills: Reads, writes, performs arithmetic, and mathematical operations, listens, and speaks.					
F1 Reading-locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.	1	2	3	4	5
F2 Writing-communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.	1	2	3	4	5
F3 Arithmetic-performs basic computations; uses basic numerical concepts such as whole numbers, etc.	1	2	3	4	5
F4 Mathematics-Approaches practical problems by choosing appropriately from a variety of mathematical techniques.	1	2	3	4	5
F5 Listening-receives, attends to, interprets, and responds to verbal messages and other cues.	1	2	3	4	5
F6 Speaking-organizes ideas and communicates orally.	1	2	3	4	5
Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons.					
F7 Creative Thinking-generates new ideas.	1	2	3	4	5
F8 Decision Making-specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative.	1	2	3	4	5
F9 Problem Solving-recognizes problems and devises and implements plan of action.	1	2	3	4	5
F10 Seeing Things in the Mind's Eye-organizes and processes symbols, pictures, graphs, objects, and other information.	1	2	3	4	5
F11 Knowing How to Learn-uses efficient learning techniques to acquire and apply new knowledge and skills.	1	2	3	4	5
F12 Reasoning-discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.	1	2	3	4	5
Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.					
F13 Responsibility-exerts a high level of effort and perseveres towards goal attainment.	1	2	3	4	5
F14 Self-Esteem believes in own self-worth and maintains a positive view of self.	1	2	3	4	5
F15 Sociability-demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings.	1	2	3	4	5
F16 Self-Management-assesses self accurately, sets personal goals, monitors progress, and exhibits self-control.	1	2	3	4	5
F17 Integrity/Honesty-chooses ethical courses of action.	1	2	3	4	5

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SCANS
Occupational Assessment
WorkPlace Know-How

The know-how identified by SCANS is made up of five competencies and a three-part foundation of skills and personal qualities needed for solid job performance. The rating level ranges from a 1 (low) to 5 (high). Please circle your response.

Competencies	Rating Scale		Rating Tabulation
	Low	High	
Resources: Identifies, organizes, plans and allocates resources.			
C1 Time-selects goal-relevant activities, ranks them, allocates time, and prepares and follows schedules.	1 2 3	4 5	
C2 Money-Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives.	1 2 3	4 5	
C3 Materials and Facilities-Acquires, stores, allocates, and uses materials or space efficiently.	1 2 3	4 5	
C4 Human Resources-Assesses skills and distributes work accordingly, evaluates performance and provides feedback.	1 2 3	4 5	
Information: Acquires and uses information.			
C5 Acquires and Evaluates Information	1 2 3	4 5	
C6 Organizes and Maintains Information	1 2 3	4 5	
C7 Interprets and Communications Information	1 2 3	4 5	
C8 Uses Computers to Process Information	1 2 3	4 5	
Interpersonal: Works with others.			
C9 Participates as Members of a Team-Contributes to group efforts.	1 2 3	4 5	
C10 Teaches Others New Skills	1 2 3	4 5	
C11 Serves client/Customers-Works to satisfy customer's expectations.	1 2 3	4 5	
C12 Exercises Leadership-Communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies.	1 2 3	4 5	
C13 Negotiates-Works toward agreements involving exchange of resources, resolves divergent interests.	1 2 3	4 5	
C14 Works with Diversity-Works well with men and women from diverse backgrounds.	1 2 3	4 5	
Systems: Understands complex Interrelationships.			
C15 Understands Systems-Knows how social, organizational, and technological systems work and operates effectively with them.	1 2 3	4 5	
C16 Monitors and Corrects Performance-Distinguishes trends, predicts impacts on system operations, diagnoses systems' performance and corrects malfunctions.	1 2 3	4 5	
C17 Improves or Designs Systems-Suggests modifications to existing systems and develops new or alternative systems to improve performance.	1 2 3	4 5	
Technology: Works with a variety of technologies.			
C18 Selects Technology-Chooses procedures, tools or equipment including computers and related technologies.	1 2 3	4 5	
C19 Applies Technology to Task-Understands overall intent and proper procedures for setup and operation of equipment.	1 2 3	4 5	
C20 Maintains and Troubleshoots Equipment-Prevents, identifies, or solves problems with equipment, including computers and other technologies.	1 2 3	4 5	

SCANS
Foundation Skills

A Three-Part Foundation

Foundation	Rating Scale	Rating Tabulation
	Low High	
Basic Skills: Reads, writes, performs arithmetic, and mathematical operations, listens, and speaks.		
F1 Reading-locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.	1 2 3 4 5	
F2 Writing-communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.	1 2 3 4 5	
F3 Arithmetic-performs basic computations; uses basic numerical concepts such as whole numbers, etc.	1 2 3 4 5	
F4 Mathematics-Approaches practical problems by choosing appropriately from a variety of mathematical techniques.	1 2 3 4 5	
F5 Listening-receives, attends to, interprets, and responds to verbal messages and other cues.	1 2 3 4 5	
F6 Speaking-organizes ideas and communicates orally.	1 2 3 4 5	
Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons.		
F7 Creative Thinking-generates new ideas.	1 2 3 4 5	
F8 Decision Making-specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative.	1 2 3 4 5	
F9 Problem Solving-recognizes problems and devises and implements plan of action.	1 2 3 4 5	
F10 Seeing Things in the Mind's Eye-organizes and processes symbols, pictures, graphs, objects, and other information.	1 2 3 4 5	
F11 Knowing How to Learn-uses efficient learning techniques to acquire and apply new knowledge and skills.	1 2 3 4 5	
F12 Reasoning-discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.	1 2 3 4 5	
Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.		
F13 Responsibility-exerts a high level of effort and perseveres towards goal attainment.	1 2 3 4 5	
F14 Self-Esteem believes in own self-worth and maintains a positive view of self.	1 2 3 4 5	
F15 Sociability-demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings.	1 2 3 4 5	
F16 Self-Management-assesses self accurately, sets personal goals, monitors progress, and exhibits self-control.	1 2 3 4 5	
F17 Integrity/Honesty-chooses ethical courses of action.	1 2 3 4 5	
		Average

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SAMPLE: SCANS INCORPORATION INTO COURSE ACTIVITIES

COURSE TITLE: ADVANCED INSTRUMENTATION FOR THE ENVIRONMENTAL LABORATORY
COURSE NUMBER: ENVT 207
CREDIT HOURS: 4
CONTACT HOURS: 128

COURSE DESCRIPTION: *Prerequiste:* CHEM 234. This course presents calibration, maintainence, and troubleshooting of instrumentation used for analysis. Topics include atomic absorption, gas chromatography, ultraviolet/visible spectroscopy, high performance liquid chromatography, Fourier Transform infrared spectrometry, light microscope, protective gear, use of computer interfaces, and an introduction to basic quality control procedures, including instrument checks. (2 Lec., 6 Lab.)

COURSE COMPETENCY: Demonstrate calibration, maintainence, and troubleshooting of instrumentation used in environmental labs.

LEARNING OUTCOMES: The student will:

Conduct performance checks
Calibrate instruments [1]
Clean equipment
Check personal protective gear
Change fluids
Add gas
Follow manufacturer's recommended maintenance schedules
Replace worn parts [1]
Troubleshoot malfunctioning instruments
Reassemble dismantled instruments [1]
Monitor measuring devices
Monitor equipment and instrument operating ranges [3]
Perform instrument system suitability [3]
Outline sample treatment process for unknown [2, 3, 4]
Select appropriate control samples for unknown [2, 3]
Perform software interface of instrumentation with computer

Activities fulfilling SCANS Competencies:

[1] Disassemble, clean, reassemble, and calibrate instrument to manufacturer's specifications **T[C20]**

[2] As part of a group, design a standards and control system for a specified procedure, including sourcing, pricing, and order schedule **IS[C9], S[C15]**

[3] Flow-chart the process for the identification and quantitation of an unknown, using the chemical literature as a source of information **I[C5, C6], S[C15]**

[4] List and price all reagents and supplies needed for a specified lab procedure, to stay within a budget **I[C5], R[C2]**

SAMPLE
SCANS CHECK SHEET

STUDENT____

ADVISOR____

PROGRAM: (circle one)
AAS
Certificate
Advanced skills: Laboratory analysis
Advanced skills: Regulatory compliance
Advanced skills: Field work

COURSE: ENVT 207 *ADVANCED INSTRUMENTATION*

SCANS Competencies incorporated in course:

COMPETENCIES	STUDENT RATING (circle one)					
	Low				High	INDUSTRY STANDARD
C2	1	2	3	4	5	2
C5	1	2	3	4	5	4
C6	1	2	3	4	5	4
C9	1	2	3	4	5	4
C15	1	2	3	4	5	3
C20	1	2	3	4	5	4

Instructor ____

Signature____

RATING SCALE: [use work place competency skills sheets]
1 Unsatisfactory: seldom completes instructor-assigned task while monitored
2 Needs improvement: completes instructor-assigned task satisfactorily while monitored
3 Acceptable: routinely completes instructor assigned-task satisfactorily and independently
4 Commendable: routinely selects and completes tasks satisfactorily and independently from an instructor-prepared agenda
5 Exemplary: routinely selects and completes appropriate tasks satisfactorily and independently from a self-planned agenda, using alternate materials, procedures, etc.

ASSOCIATE OF APPLIED SCIENCE IN ENVIRONMENTAL TECHNOLOGY
DEGREE PLAN

NAME____ SSN____________________

ADDRESS____ PHONE____________________

CITY____ STATE__________ ZIP__________

ADVISOR____________________ SEMESTER ENROLLED__________ SEMESTER GRADUATED__________

Course	Date Completed	Grade	Transfer/ Options/ Substitute	Instructor SCANS ✓	Comments
FIRST YEAR-SEMESTER ONE					
ENV 101 Intro to Environmental Science and Safety					
CHEM 101 General Chemistry					
ENG 101 Composition I					
MATH 101 College Algebra					
Elective Behavioral/Social Science					
FIRST YEAR-SEMESTER TWO					
ENT 102 Laboratory Management and Documentation					
CHEM 102 General Chemistry					
BIOL 223 Environmental Biology					
SC 101 Speech Communications					
CMT 124 Electrical and Mechanical Equipment					
SECOND YEAR-SEMESTER ONE					
CHEM 203 Quantitative Analysis					
ENV 105 Biochemical Processes					
ENV 106 Calculations for Environmental Technology					
ENV 202 Hazardous Materials					
ENV 206 Industrial Processes and Procedures					
SECOND YEAR-SEMESTER TWO					
CHEM 234 Instrumental Analysis					
ENV 201 Sampling and Field Testing					
ENV 250 Cooperative Work Experience					
Elective Humanities					
Free Elective					

LABORATORY ASSISTANT: CERTIFICATE IN ENVIRONMENTAL TECHNOLOGY
DEGREE PLAN

NAME______________________________ SSN________________

ADDRESS____________________________ PHONE________________

CITY______________________________ STATE________ ZIP________

ADVISOR______________ SEMESTER ENROLLED________ SEMESTER GRADUATED________

Course	Date Completed	Grade	Transfer/ Options/ Substitute	Instructor SCANS ✓	Comments
FIRST YEAR-SEMESTER ONE					
ENV 101 Intro to Environmental Science and Safety					
CHEM 101 General Chemistry					
ENG 101 Composition I					
MATH 101 College Algebra					
BIOL 223 Environmental Biology					
FIRST YEAR-SEMESTER TWO					
ENT 102 Laboratory Management and Documentation					
CHEM 102 General Chemistry					
ENVT 105 Biochemical Processes					
ENVT 106 Calculations for Environmental Technology					
ENVT 700 Cooperative Work Experience					

ENVIRONMENTAL TECHNOLOGY
ADVANCED SKILLS CERTIFICATES

NAME______________________________ SSN________________

ADDRESS____________________________ PHONE_______________

CITY_______________________________ STATE________ ZIP______

ADVISOR______________ SEMESTER ENROLLED________ SEMESTER GRADUATED________

AAS in Environmental Technology/Date completed________________

Course	Date Completed	Grade	Transfer/ Options/ Substitute	Instructor SCANS ✓	Comments

Advanced Skills: Laboratory Analysis

ENVT 207 Advanced Instrumentation for the Environmental Laboratory					
ENVT 208 Analysis in Complex Matrices					

Advanced Skills: Regulatory Compliance

ENVT 209 Interpreting Government Regulations					
ENVT 210 Employee Right-to-Know Programs					

CONTACTS, PUBLISHERS, AND PUBLICATIONS 58
REFERENCES 66
ARTICLES 76

RESOURCES

Contacts, Publishers and Publications

California Business Environmental Assistance Center
100 S. Anaheim Boulevard, Ste 125
Anaheim, California 92805
714-563-0866
(instructor guides & materials for hazardous materials management)

Hazardous Materials Training and Research Institute
306 West River Drive
Davenport, Iowa 52801
Ordering address:
    Martini Print Media, Inc.
    6320-116 Capitol Boulevard
    Raleigh, North Carolina 27604
    919-872-6601 Fax: 919-872-6626

National Center for Research in Vocational Education
University of California at Berkeley
1995 University Avenue, Ste 375
Berkeley, california 94704
(educational trends and employment needs)

Partnership for Environmental Technology Education (PETE)
Paul R. Dickinson
Executive Director
6601 Owens Drive, Suite 235
Pleasanton, California 94588
Phone: 510-225-0669 Fax: 510-225-0679

In Texas contacts for PETE are:

Mrs. Lea Campbell
Lamar University
1500 Procter Street
P.O. Box 310
Port Arthur, Texas 77641-0310
Phone 409-727-0886, Ext: 327
Fax:409-985-4578

Dr. Doug Pickle
Amarillo College - West Campus
P.O. Box 447
Amarillo, Texas 79178
Phone: 806-371-5000
Fax: 806-354-6096

ENVIRONMENTAL SCIENCE/HAZARDOUS MATERIALS MANAGEMENT

TEXTBOOKS AND REFERENCE BOOK LIST

ENVIRONMENTAL SCIENCE/HAZARDOUS MATERIALS MANAGEMENT

Environmental Progress, and Challenges, EPA'S Update.
Pub: EPA/230-07-88-033

Environmental Science
Anderson, Stanley H.; Beiswenger, Ronald E.; Purdom, P. Walton
Macmillan ISBN 0-02-303191-3

Environmental Science: Living Within the System of Nature
Hyland, Margaret C.; Kupchella, Charles E.
Allyn and Bacon ISBN 0-205-11723-6 (Second Edition)

Environmental Science: Sustaining the Earth
Miller, Tyler G., Jr.
Wadsworth Inc ISBN 0-534-13458-0 (Third Edition)

Envitonmental Science: The Study of Interrelationships
Enger, Eldon D.; Kormelink, Richard J.; Smith, Bradley F.;
Smith Rodney J..
WM. C. Brown ISBN 0-697-05134-X

Environmental Science: The Way the World Works
Nebel, Bernard J.
Prentice Hall ISBN 0-13-282260-1 (Third Edition)

Guide to the Management of Hazardous Waste
Haun, J. William, Jr.
Fulcrum Publishing ISBN 1-55591-065-3

Hazardous Materials Management
Carson, Tom H.; Cox, Doye B.
(Fourth Edition) Institute of Hazardous Materials Management
Library of Congress Catalog Card Number 90-81996

Hazardous Waste Management
Dawson, Gaynor W.; Mercer, Basil W.
John Wiley & Sons ISBN 0-471-82268-X

Hazardous Waste Management
Wentz, Charles A.
Pub: McGraw Hill ISBN: 0-07-069291-2

Hazardous Waste Management: Reducing The Risk
Goldman, Benjamin; Hulme, James and Johnson, Cameron
Island Press ISBN 0-933280-30-0

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Man & Environment: A Health Perspective
Nadakavukaren, Anne
Anne Nadakavukaren ISBN 0-88133-445-6 (Third Edition)

Principles of Hazardous Materials Management
Griffin, Roger D.
Lewis Publishers ISBN 0-87371-145-9

Solid Waste Management and the Environment: The Mounting Garbage and Trash Crisis
Neal, Homer A.; Schubel, J.R.
Prentice-Hall ISBN 0-13-822891-4

State of the Environment: A View Toward the Nineties
Conservation Foundation ISBN 0-89164-098-3

War on Waste
Blumberg, Louis; Gottlieb, Robert
Island Press ISBN 0-933280-91-2

OSHA HEALTH & SAFETY

Chemical Protective Clothing Performance Index Book
Forsberg, Krister.
John Wiley and Sons, Inc. ISBN 0-471-51430-6

Environmental Health and Safety
Koren, Herman
Lewis ISBN 0-87371-272-2(Vol 1) ISBN 0-87371-414-8 (Vol 2)

Environmental Health and Safety: "40 Hour" OSHA Training
Barth, Richard C.
McGraw-Hill Available in 1994

Handbook of Hazard Comminications and OSHA Requirements
Lowery, George G.; Lowery, Robert C.
Lewis ISBN 0-87371-022-3

NIOSH Pocket Guide to Chemical Hazards
Pub:U.S. Dept of Health and Human Services.
D H S H (NIOSH) Pub: 90-177

OSHA Health and Safety Update
Pub: FRCC Hazmatt Dept.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities
Pub: U.S. Dept of Health And Human Services.
D H H S (NIOSH) Pub: Number 85-115

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices
Pub: American Conference of Government Industrial Hygienists.
ISBN: 0-936712-99-6

ENVIRONMENTAL REGULATIONS

Chemical Communication Guidebook
Hinds, Richard deC.; Waldo, Andrew B.
McGraw Hill ISBN 0-07-067755-7

Code of Federal Regulations
29 CFR Labor
40 CFR Protection of Environment
49 CFR Trasnportation

Colorado Hazardous Waste Regulations.
Pub: Colorado Department of Health. 6 CCR 1007-3

Environemtnal Audits
Cahill, Lawrence and Kane, Raymond.
Government Institutes, Inc. ISBN 0-86587-776-9

Environmental Law for Engineers Scientists, and Managers
Bockrath, Joseph
McGraw-Hill ISBN 0-07-006327-3

Environmental Law Handbook
Arbuckle, J. Gordon et al
Government Institutes, Inc. ISBN 0147-7714

Legal Issues In Hazardous Materials Management.
In Preparation: FRCC HAZMATT Department.

Pesticide Regulations Handbook (Third Edition)
McKenna & Cuneo
McGraw-Hill ISBN 0-07-546322-9

RCRA Orientation Manual 1990 Edition
EPA Office of Solid Waste EPA/530-SW-90-036

RCRA Regulations and Kewword Index 1993 Edition
McCoy and Associates, Inc. ISBN 0-930469-14-3

The Hazardous Waste Q & A
Wagner, Travis P.
Van Nostrand Reinhold ISBN 0-442-23842-8

Toxic Substances Control Guide Second Edition.
Worobec, Mary Devine and Hogue, Cheryl
The Bureau of National Affairs. ISBN: 0-87179-752-6

US Environmental Laws
McClain, Wallis E., Jr.
Bureau of National Affairs ISBN 0-87179-656-2

SITE ASSESSMENT

Site Assessments
Barth, Richard C.
McGraw-Hill ISBN 0-07-005146-1

ENVIRONMENTAL SAMPLING

Environmental Sampling and Analysis: A Practical Guide
Keith, Lawrance H., Ph.D
Lewis ISBN 0-87371-381-8

Hazardous Waste Measurements
Simmons, Milagros S.
Lewis ISBN 0-87371-171-8

Hazardous Waste Site Remediation: The Engineer's Perspective
O'Brien & Gere Engineers Inc.
Van Nostrand Reinhold ISBN 0-442-27210-3

Principles of Environemtnal Sampling
Keith, Lawrence.
American Chemical Society ISBN 0-8412-1173-6

Sampling and Monitoring of Environmental Contaminants
Barth, Richard C. and Topper, Karl
McGraw-Hill ISBN 0-07-005153-4

Wildland Water Quality Sampling and Analysis
Stednick, John D.
Academic Press, Inc. ISBN 0-12-664100-5

TREATMENT, STORAGE AND DISPOSAL

Chemical Fixation and Solidification of Hazardous Waste
Conner, Jesse R.
Van Nostrand Reinhold (ISBN 0-442-20511-2)

Standard Handbook of Hazardous Waste Treatment and Disposal
Freeman, Harry
McGraw-Hill. ISBN 0-07-5-022042-5

Standard Handbook of Environmental Engineering
Corbitt, Robert A.
McGraw-Hill ISBN 0-07-013158-9

Environmental Pollution and Control
Peirce, Jeffrey J.; Vesilind, P. Aarne; Weiner, Ruth F.
Butterworth-Heinemann ISBN 0-409-90272-1

Hazardous and Toxic Materials: Safe Handling and Disposal
Fawcett, Howard.
John Wiley and Sons ISBN 0-471-62729-1

Industrial and Hazardous Waste Treatment
Nemerow, Nelson Leonard
Van Nostrand Reinhold ISBN 0-442-31934-7

Industrial Waste Disposal
Ross, R. D.
Reinhold Library of Congress Library Card Number: 68-17866

Recycling & Incineration
Denison, Richard A.; Ruston, John
Island Press ISBN 1-55963-054-X

Recycling and Incineration: Evaluating the Choices
Denison, Richard and Ruston, John.
Environemtnal Defense Fund, Inc. (ISBN 1-55963-054-X)

Subsurface Migration of Hazardous Waste
Devinny, Joseph; Everett, Lorne; Lu,James; Stollar, Robert
Van Nostrand Reinhold ISBN 0-442-21868-0

Water-Resourses Engineering
Franzini, Joseph B.; Lindsey, Ray K.
McGraw-Hill ISBN 07-037959-9

Water Treatment
James, G.V.
Technical Press LTD (Third Edition)

HAZARDOUS WASTE MINIMIZATION/POLLUTION PREVENTION

Hazardous Waste Minimization
Freeman, Harry M.
Pub: McGraw Hill   ISBN 0-07-022043-3

Hazardous Waste Minimization Handbook
Higgins, Thomas E.
Lewis Publishers   ISBN 0-87371-176-9

Facility Pollution Prevention Guide
EPA Office of Research and Developement EPA/600/R-92/088

Industrial Pollution Prevention Oppertunities for the 1990s
Office of Research and Developement EPA/600/8-91/052

Pollution Pervention
McGuinn, Young C.; Theodore, Louis
Van Nostrand Reinhold ISBN 0-442-00606-3

Pollution Prevention and Hazardous Waste Minimization
Freeman, Harry and Boon, David (In Prep: 1994)

The Recycling Handbook
Lund, Herbert F.
McGraw-Hill   ISBN 0-07-039096-7

CHEMISTRY OF HAZARDOUS MATERIALS

Chemical Sensitivity
Rea, William
CRC Press Inc. ISBN 0-87371-541-1

Chemistry of Hazardous Materials Second Edition
Meyer, Eugene
Prentice Hall ISBN: 0-89303-113-X

Chemtrex: Small- Scale for General Chemistry
Thompson, Stephen
Stephen Thompson ISBN 0-205-11913-1

Industrial Chemical Exposure: Guidelines for Biological Monitoring
Lauwerys, Robert; Hoet, Perrine
CRC Press, Inc. ISBN 0-87371-650-7

Low-Level Radioactive Waste
Gershey, Edward L.; Klein, Robert C.; Party, Esmeralda; Wilkerson, Amy
Van Norstrand Reinhold ISBN 0-442-23958-0

Multiple Chemical Interactions
Calabrese, Edward
Lewis Publishers, Inc. ISBN 0-87371-146-7

Toxicological Chemistry
Manahan, Stanley.
ELewis Publishers, Inc. ISBN 0-87371-149-1

Toxicology
Kamrin, Michael A.
Lewis Publishers ISBN 0-87371-133-5

Understanding Radioactive Waste
Murray, Raymond L.
Battelle Press ISBN 0-935470-425 (Third Edition)

ENVIRONMENTAL-GENERAL

Asbestos Worker Training Manual.
Asbestos Training for Inspectors.
Asbestos Management Planner Training Manual.
Asbestos Regulations Manual.
All Published by the FRCC Hazmatt Dept.

Basic Radiation Protection Technology Second Edition.
Pacific Radiation Corp. ISBN 0-916339-04-1

Emergency Response Level I, First Responder Awareness.
Emergency Response Level II First Responder Operations Student's Guide.
Emergency Response Level III First Responder Technician.
All published by the FRCC Hazmatt Dept

Environemtnal Epidemology and Risk Assessment
Aldrich, Tim
Van Nostrand Reinhold ISBN 0-442-00885-6

Environemtnal Radon: Occurrence, Control and Health Hazards
Majumdar, Shyamal; Schmalz, Robert and Miller, Willard
Pennsylvania Academy of Science Publications ISBN 0-945809-03-4

Ground Water Pollution Control
Canter, Larry
Lewis Publishers, Inc. (ISBN 0-87371-014-2)

Handling Hazardous Materials.
Dept of Safety, American Trucking Associations. Order No.C0990

Air Quality
Godish, Thad
Lewis ISBN 0-87371-368-0

Indoor Air Pollution Control
Godish, Thad
Lewis ISBN 0-87371-098-3

Indoor Air Pollution: Problem and Properties
Leslie, G. B.; Lunau, F. W.
Cambridge ISBN 0-521-38510-5

Infectious Waste Management
Cross, Frank L.; Hesketh, Howard E.; Rykowski, P. Kay
Technomic ISBN 87762-751-7

Introduction to Indoor Air Quality: A Reference Manual
National Environmental Health Association EPA/400/3-91/003

Wetlands
Mitsch, William
Van Nostrand Reinhold ISBN 0-442-26398-8

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Working References

DACUM Handbook
Center on Education and Training for Employment
The Ohio State University
1900 Kenny Road
Columbus, Ohio 43210
614-292-4353 or 800-848-4815

Forces for Change Shaping the Future of Texas,
Volume I, Volume II, Part I and Volume II, Part II,
John Sharp
Comptroller of Public Accounts
Research Division
P.O. Box 13528
Austin, Texas 78711-9831
Phone: 800-531-5441; Ext: 3-4900

Implementing Competency-Based Education: A Resource Guide
(Series PVEP-1030/Curriculum Development)
Texas State Technical College, Amarillo
Instructional Services
P.O. Box 11197
Amarillo, Texas 79111
806-335-2316, 800-227-8784

Technical Education Program Guidelines
Texas Higher Education Coordinating Board
P.O. Box 12788
Austin, Texas 78711
Phone: 512-483-6250
Fax: 512-483-6444

Quality Work Force Planning Resource Guide:
Occupational Information for Programs and
Curriculum Development and College and Career Counseling, 1993, 1994, editions
A Pilot Identification of Emerging Occupations in Texas: September 1989
The Texas Innovation Information Network System
1950 Stemmons Freeway
Suite 5037 D
Dallas, Texas 50370
Phone: 214-746-5140

Texas Quality Work Force Planning for the 21st Century
Quality Work Force Planning Unit
Texas Education Agency
1701 North Congress Avenue
Austin, Texas 78701-1494
512-475-3428

What Work Requires of Schools
Learning a Living: A Blueprint for High Performance
U.S. Department of Labor
Secretary's Commission on Achieving Necessary Skills
200 Constitution Avenue, NW
Washington, DC, 20210
800-788-SKILL

The Environmental Career Guide

Job Opportunities with the Earth in Mind

NICHOLAS BASTA

John Wiley & Sons, Inc.

New York • Chichester • Brisbane • Toronto • Singapore

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APPENDIX A

Nonprofit Organizations

Air and Waste Management Association
P.O. Box 2861
Pittsburgh PA 15230
(412) 232 3444

Alliance for Engineering in Medicine and Biology
1101 Connecticut Ave., NW
Washington, DC 20036
(202) 857 1199

Alliance for Environmental Education Inc.
10751 Ambassador Dr., Suite 201
Manassas, VA 22110
(703) 335 1025

American Academy of Environmental Engineers
132 Holiday Ct., Suite 206
Annapolis, MD 21401
(301) 266 3311

American Association for the Advancement of Science
1333 H St., NW
Washington, DC 20005
(202) 326 6400

American Chemical Society
1155 16th St., NW
Washington, DC 20036
(202) 872 4600

American Conference of Governmental Industrial Hygienists
6500 Glenway Ave., Bldg. D-7
Cincinnati, OH 45211
(513) 661 7881

American Council of Independent Laboratories
Suite 412
1725 K St., NW
Washington, DC 20006
(202) 887 5872

American Entomological Society
1900 Race St.
Philadelphia, PA 19103
(215) 561 3978

American Farmland Trust
1920 N St., NW, Suite 400
Washington, DC 20036
(202) 659 5170

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American Fisheries Society
5410 Grosvenor Lane
Suite 110
Bethesda, MD 20814
(301) 897 8616

American Forestry Association
P.O. Box 2000
Washington, DC 20013
(202) 667 3300

American Industrial Hygiene Association
475 Wolf Ledges Parkway
Akron, OH 44311
(216) 762 7294

American Institute of Aeronautics and Astronautics
370 L'Enfant Promenade, SW
Washington, DC 20024
(202) 646 7400

American Institute of Architects
1735 New York Ave., NW
Washington, DC 20006
(202) 626 7300

American Institute of Chemical Engineers
345 East 47th St.
New York, NY 10017
(212) 705 7338

American Institute of Mining, Metallurgical and Petroleum Engineers (AIME)
345 East 47th St.
New York, NY 10017
(212) 705 7695

American Institute of Physics
335 East 45th St.
New York, NY 10017
(212) 661 9404

American Institute of Plant Engineers
3975 Erie Ave.
Cincinnati, OH 45208
(513) 561 6000

American Nuclear Society
555 North Kensington Ave.
La Grange Park, IL 60525
(708) 352 6611

American Planning Association
1776 Massachusetts Ave., NW
Washington, DC 20036
(202) 872 0611

American Public Health Association
1015 15th St., NW
Washington, DC 20005
(202) 789 5600

American Rivers
801 Pennsylvania Ave., SE
Washington, DC 20003
(202) 547 6900

American Society for Microbiology
1913 Eye St., NW
Washington, DC 20006
(202) 833 9680

American Society of Agricultural Engineers
2950 Niles Rd.
St. Joseph, MI 49085
(616) 429 0300

American Society of Agronomy
677 South Segoe Rd.
Madison, WI 53711
(608) 273 8080

American Society of Civil Engineers
Student Services Dept.
345 East 47th St.
New York, NY 10017
(212) 705 7496

American Society of Consulting Planners
210 7th St.
Washington, DC 20003

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
1791 Tulie Circle, NE
Atlanta, GA 30329
(404) 636 8400

American Society of Mechanical Engineers
345 East 47th St.
New York, NY 10017
(212) 705 7722

American Society of Safety Engineers
1800 E. Oakton St.
Des Plaines, IL 60018
(708) 692 4121

American Water Resources Association
5410 Grosvenor Lane
Bethesda MD 20814
(301) 493 8600

American Water Works Association
6666 W. Quincy Ave.
Denver, CO 80235
(303) 794 7711

American Wilderness Alliance
7600 E. Arapahoe Rd., Suite 114
Englewood, CO 80112
(303) 771 0380

Association of American Geographers
1710 16th St., NW
Washington, DC 20009
(202) 234 1450

Association of Corporate Environmental Officers
P.O. Box 4117
Timonium, MD 21093
(800) 876 6618

Association of Environmental and Resource Economists
1616 P St., NW
Washington, DC 20036
(202) 328 5000

Association of Ground Water Scientists and Engineers
6375 Riverside Dr.
Dublin, OH 43017
(614) 761 1711

Association of State and Interstate Water Pollution Control Administrators
444 N Capitol St., NW
Washington, DC 20001

Board of Certified Safety Professionals
208 Burwash Ave.
Savoy, IL 61874
(217) 359 9263

Center for Hazardous Materials Research
320 William Pitt Way
Pittsburgh, PA 15238
(412) 826 5320

Center for Marine Conservation
1725 DeSales St., NW
Washington, DC 20036
(202) 429 5609

Citizen's Clearinghouse for Hazardous Waste, Inc.
P.O. Box 926
Arlington, VA 22216
(703) 276 7070

Citizens for a Better Environment
942 Market St., No. 505
San Francisco, CA 94102
(415) 788 0690

Clean Water Action Project
317 Pennsylvania Ave., SE
Washington, DC 20003
(202) 547 1196

The Conservation Foundation
1250 24th St., NW
Washington, DC 20037
(202) 293 4800

Conservation International
1015 18th St., NW, Suite 1000
Washington, DC 20036
(202) 429 5660

Cousteau Society, Inc.
930 W. 21st. St.
Norfolk, VA 23517
(804) 627 1144

Defenders of Wildlife
1244 19th St., NW
Washington, DC 20036
(202) 659 9510

Earthwatch
P.O. Box 403N
Watertown, MA 02272
(617) 926 8200

Ecology Center
1403 Addison St.
Berkeley, CA 94702
(415) 548 2220

Entomological Society of America
9301 Annapolis Rd.
Lanham, MD 20706
(301) 731 4535

Environmental Action
1525 New Hampshire Ave., NW
Washington, DC 20036
(202) 745 4870

Environmental Defense Fund
257 Park Ave. South
New York, NY 10010
(212) 505 2100

Environmental Law Institute
1616 P St., NW, Suite 200
Washington, DC 20036
(202) 328 5150

Freshwater Foundation
2500 Shadywood Rd.
Navarre, MN 55392

Friends of the Earth
218 D St., SE
Washington, DC 20003
(202) 544 2600

Geological Society of America
3300 Penrose Place
Boulder, CO 80301
(303) 447 2020

Green Cross Certification Co.
1611 Telegraph Ave., Suite 1111
Oakland, CA 94612
(415) 832 1415

Greenpeace USA
1436 U St., NW
Washington, DC 20009
(202) 462 1177

Green Seal, Inc.
1733 Connecticut Ave., NW
Washington, DC 20009
(202) 328 8095

Hazardous Materials Control Research Institute
7237 Hanover Parkway
Greenbelt, MD 20770
(301) 982 9500

Institute for Local Self-Reliance
2425 18th St., NW
Washington, DC 20009
(202) 232 4108

Institute of Electrical and Electronics Engineers, Inc.
345 East 47th St.
New York, NY 10017
(212) 705 7900

Institute of Environmental Sciences
940 E. Northwest Highway
Mt. Prospect, IL 60056
(312) 255 1561

Institute of Industrial Engineers
25 Technology Park
Norcross, GA 30092
(404) 449 0460

Institute of Scrap Recycling Industries
1627 K St., NW
Washington, DC 20006
(202) 466 4050

International Association of Environmental Managers
243 W. Main St.
P.O. Box 308
Kutztown, PA 19530
(215) 683 5098

The Izaak Walton League of America
1401 Wilson Blvd., Level B
Arlington, VA 22209
(703) 528 1818

Junior Engineering Technical Society (JETS)
1420 King St.
Alexandria, VA 22314
(703) 548 5387

League of Conservation Voters
1150 Connecticut Ave., NW, Suite 201
Washington, DC 20036
(202) 785 8683

National Association for Environmental Management
4400 Jenifer St., NW
Washington, DC 20015
(202) 966 0019

National Association of
Environmental Professionals
P.O. Box 15210
Alexandria, VA 22309
(703) 660 2364

National Association of Professional
Environmental Communicators
P.O. Box 06 8352
Chicago, IL 60606
(312) 781 1505

National Audubon Society
950 Third Ave.
New York, NY 10022
(212) 832 3200

National Environmental
Development Association
1440 New York Ave., NW, Suite 300
Washington, DC 20005
(202) 638 1230

National Environmental Health
Association
720 S. Colorado Blvd.
#970 South Tower
Denver, CO 80222
(303) 756 9090

National Recycling Coalition
1101 30th St., NW, Suite 305
Washington, DC 20007
(202) 625 6406

National Society of Professional
Engineers
1420 King St.
Alexandria, VA 22314
(703) 684 2800

National Solid Wastes Management
Association
1730 Rhode Island Ave., NW
Washington, DC 20036
(202) 659 4613

National Toxics Campaign
37 Temple Place, 4th Floor
Boston, MA 02111
(617) 482 1477

National Water Well Association
6375 Riverside Dr.
Dublin, OH 43017
(614) 761 1711

National Wildlife Federation
1400 16th St., NW
Washington, DC 20036
(202) 797 6800

Natural Resources Defense Council
40 West 20th St.
New York, NY 10011
(212) 727 2700

Nature Conservancy
1815 N. Lynn St.
Arlington, VA 22209
(703) 841 5300

New Alchemy Institute
237 Hatchville Rd.
East Falmouth, MA 02536
(508) 564 6301

North American Association for
Environmental Education
P.O. Box 400
Troy, OH 45373
(513) 698 6493

Operations Research Society of
America
Mt. Royal & Guilford Ave.
Baltimore, MD 21202
(301) 528 4146

Organic Crop Improvement
Association
3185 Township Rd. 179
Bellafontaine, OH 43311
(513) 592 4983

Organic Food Alliance
2111 Wilson Blvd., Suite 531
Arlington, VA 22201
(703) 276 9498

Resource Policy Institute
P.O. Box 39185
Washington, DC 20016
(202) 895 2601

Sierra Club
730 Polk St.
San Francisco, CA 94109
(415) 776 2211

Society of Automotive Engineers
400 Commonwealth Dr.
Warrendale, PA 15096
(412) 776 4841

Society for Ecological Restoration
c/o University of Wisconsin
Arboretum
1207 Seminole Highway
Madison, WI 53711
(608) 263 7889

Society of Environmental Toxicology
and Chemistry
1101 14th St., NW, Suite 1100
Washington, DC 20005
(202) 371 1275

Society of Fire Protection Engineers
60 Batterymarch St.
Boston, MA 02110
(617) 482 0686

Society of Manufacturing Engineers
One SME Dr.
Dearborn, MI 48121
(313) 271 1500

Society of Plastics Engineers
14 Fairfield Dr.
Brookfield, CT 06804
(203) 775 0471

Society of Toxicology
1101 14th St., NW, Suite 1100
Washington, DC 20005
(202) 293 5935

Soil and Water Conservation Society
7515 N.E. Ankeny Rd.
Ankeny, IA 50021
(515) 289 2331

Soil Science Society of America
677 South Segoe Rd
Madison, WI 52711
(608) 273 8080

State and Territorial Air Pollution
Program Administrators and the
Association of Local Air Pollution
Control Officials
444 N. Capitol Street, NW
Washington, DC 20001
(202) 624 7864

Student Conservation Association,
Inc.
P.O. Box 550
Charlestown, NH 03603
(603) 826 4301

Union of Concerned Scientists
26 Church St.
Cambridge, MA 02238
(617) 547 5552

Waste Watch
P.O. Box 39185
Washington, DC 20016
(202) 895 2601

Water Pollution Control Federation
601 Wythe St.
Alexandria, VA 22314
(703) 684 2400

The Wilderness Society
900 17th St., NW
Washington, DC 20006
(202) 833 2300

World Resources Institute
1709 New York Ave., NW
Washington, DC 20006
(202) 638 6300

Worldwatch Institute
1776 Massachusetts Ave., NW
Washington, DC 20036
(202) 452 1999

World Wildlife Fund
1250 24th St., NW
Washington, DC 20037
(202) 293 4800

Zero Population Growth
1400 16th St., NW
Suite 230
Washington, DC 20036
(202) 332 2200

APPENDIX B

Environmental Publications

Following is a list of publications about social issues, industrial practices, and some scientific research on environmental topics. I have excluded most academic journals in favor of those that are accessible to the general reader. At the same time, there is an emphasis on business publications. The main reason for this focus is to provide the publications that would be most useful to the job hunter; academic journals, while extremely valuable for environmental science, are written mostly for other scientists. Most of the business journals are not available on newsstands, and some of them actually restrict their subscriptions to those working in an industry. (You can usually get around this restriction by calling yourself a "consultant" on the subscription form.) Most large university libraries will have many of these publications on hand, as will many corporate libraries.

Amicus Journal
40 West 20th St.
New York, NY 10011
(212) 727 2700
(House organ of the Natural Resources Defense Council)

BioCycle, the Journal of Waste Recycling
The JG Press, Inc.
P.O. Box 351
18 South Seventh St.
Emmaus, PA 18049
(215) 967 4135

Buzzworm, The Environmental Journal
2305 Canyon Blvd., Suite 206
Boulder, CO 80302
(303) 442 1969

California Environmental News

Tri-State Environmental News

Texas Environmental News

Environmental News Network
760 Whalers Way, Suite 100 A
Fort Collins, CO 80525
(303) 229 0029

Chemical & Engineering News
1155 16th St., NW
Washington, DC 20036
(202) 872 4600
(House journal of the American Chemical Society)

Chemical Engineering
1221 Ave. of Americas, 43rd Fl.
New York, NY 10020
(212) 512 2000

Chemical Engineering Progress
American Institute of Chemical Engineers
345 East 47th St.
New York, NY 10017
(212) 705 7576
(House journal of the American Institute of Chemical Engineers)

Chemical Week
Chemical Week Associates
P.O. Box 1074
Southeastern, PA 19398
(215) 630 6380

Civil Engineering
American Society of Civil Engineers
345 East 47th St.
New York, NY 10017
(212) 705 7496

Clean Water Report
CIE Associates
237 Gretna Green Ct.
Alexandria, VA 22304

E, The Environmental Magazine
Earth Action Network, Inc.
28 Knight St.
Norwalk, CT 06851
(203) 854 5559

Earth First! The Radical Environmental Journal
P.O. Box 5871
Tucson, AZ 85703

Engineering News-Record
1221 Ave. of Americas
New York, NY 10020
(212) 512 2500

Environmental Business Journal
Environmental Business Publishing Inc.
827 Washington
San Diego, CA 92103
(619) 295 7685

Environmental Economics Journal
30 Springborn St.
Enfield, CT 06082

EPRI Journal
Electric Power Research Institute
P.O. Box 10412
Palo Alto, CA 94303
(415) 855 2000

Environmental Science and Technology
American Chemical Society
1155 16th St., NW
Washington, DC 20036
(202) 872 4600

Golub's Oil Pollution Bulletin
World Information Systems
P.O. Box 535 Havard Square Station
Cambridge, MA 02238

Graduating Engineer
Peterson's/COG Publishing Group
16030 Ventura Blvd., Suite 560
Encino, CA 91436
(818) 789 5293

Hazardous Materials Control
Hazardous Materials Control Institute
7237 Hanover Pky.
Greenbelt, MD 20770
(301) 982 9500

Hazmat World
Tower-Borner Publishing, Inc.
800 Roosevelt Rd.
Glen Ellyn, IL 60137

In Business, the Magazine for Environmental Entrepreneuring
The JG Press, Inc.
P.O. Box 323
18 South Seventh St.
Emmaus, PA 18049
(215) 967 4136

Inside EPA
301 G St., SW
Washington, DC 20024

The Journal of Conservation Biology
Society for Conservation Biology
3 Cambridge Center
Cambridge, MA 02141
(617) 225 0401

Journal of Environmental Health
National Environmental Health Association
720 S. Colorado Blvd.
Denver, CO 80222
(303) 756 9090

Journal of Soil and Water Conservation
Soil and Water Conservation Society
7515 NE Ankeny Rd.
Ankeny, IA 50021
(515) 289 2331

Journal of the Water Pollution Control Federation
601 Wythe St.
Alexandria, VA 22314

National Parks
National Parks and Conservation Association
1015 31st St., NW
Washington, DC 20007
(202) 944 8530

Natural History
P.O. Box 5000
Harlan, IA 51537
1 (800) 234 5252

New Age Journal
342 Western Ave.
Brighton, MA 02135
(617) 787 2005

Organic Times
New Hope Communication
1301 Spruce St.
Boulder, CO 80302

Pollution Engineering
1935 Shermar Rd.
Northbrook, IL 60062
(708) 498 9840

Pulp & Paper
500 Howard St.
San Francisco, CA 94105
(415) 397 1881

REAP Newsletter
Iowa Department of Natural Resources
Wallace State Office Bldg.
Des Moines, IA 50319

Resource Recovery Focus
National Solid Wastes Management
Association
1730 Rhode Island Ave., NW
Washington, DC 20036
(202) 659 4613

Resource Recycling
Resource Recycling, Inc.
P.O. Box 10540
Portland, OR 97210
(503) 227 1319

Science
American Association for the
Advancement of Science
1333 H St., NW
Washington, DC 20005
(202) 326 6400

Waste Tech News
131 Madison St.
Denver, CO 80206
(303) 394 2905

Water Resources Review
U.S. Geological Survey
MS 20
12201 Sunrise Valley Dr.
Reston, VA 22092
(703) 860 6127

Water Well Journal
Water Well Journal Publishing Co.
6375 Riverside Dr.
Dublin, OH 43017

Whole Earth Ecolog
available through bookstores or
Whole Earth Access
2990 Seventh Ave.
Berkeley, CA 94710
(800) 845 2000
(415) 845 3000

APPENDIX C

Federal Addresses

Most of the larger federal agencies have regional hiring offices in addition to the headquarters office in Washington. Also, the very largest federal agencies have hiring centers for divisions within the agency as well as the agency as a whole. Some of these divisional offices are listed here, under the title of the parent agency. The U.S. Environmental Protection Agency is listed first, including its ten regional offices. The publication *Career America*, from which all these addresses were drawn, lists most of the regional and divisional addresses and should be consulted for more details.

ENVIRONMENTAL PROTECTION AGENCY

Headquarters Office

Recruitment Center
(PM-224)
401 M St., NW
Washington, DC 20460
1 (800) 338 1350
(202) 382 3305

Regional Offices

Regional Personnel Office
Environmental Protection Agency
Room 2203
John F. Kennedy Bldg.
Boston, MA 02203
(617) 565 3719
(CT, ME, MA, NH, RI, VT)

Regional Personnel Office
Environmental Protection Agency
Room 937 C
26 Federal Plaza
New York, NY 10278
(212) 264 0016
(NY, NY, PR, VI)

Regional Personnel Office
Environmental Protection Agency
841 Chestnut Bldg
Philadelphia, PA 19107
(215) 597 9372
(DE, MD, DC, PA, VA, WV)

Regional Personnel Office
Environmental Protection Agency
345 Courtland St., NE
Atlanta, GA 30365
(404) 347 3486
(AL, FL, GA, KY, MS, TN, NC, SC)

Regional Personnel Office
Environmental Protection Agency
230 South Dearborn St.
Chicago, IL 60604
(312) 353 2026
(IL, IN, MN, MI, OH, WI)

Regional Personnel Office
Environmental Protection Agency
1445 Ross Ave.
Dallas, TX 75202
(214) 655 6560
(AR, LA, NM, TX, OK)

Regional Personnel Office
Environmental Protection Agency
726 Minnesota Ave.
Kansas City, KS 66101
(913) 236 2821
(IA, KS, MO, NE)

Regional Personnel Office
Environmental Protection Agency
One Denver Place
999 18th St., Suite 500
Denver, CO 80202
(303) 293 1487
(CO, MT, ND, SD, UT)

Regional Personnel Office
Environmental Protection Agency
215 Fremont St.
San Francisco, CA 94105
(415) 974 8016
(AZ, CA, NV, HW, Guam,
American Samoa, Trust Territories,
Wake Island)

Regional Personnel Office
Environmental Protection Agency
M/S 301
1200 Sixth Ave.
Seattle, WA 98101
(206) 442 2959
(ID, OR, WA, AK)

DEPARTMENT OF AGRICULTURE

Office of Personnel
Central Employment Unit
U.S. Department of Agriculture
Room 1080, South Building
Washington, DC 20250
(202) 447 5626

Agricultural Research Service

Personnel Division
Building 003, BARC-West
Beltsville, MD 20705
(301) 344 1124

Forest Service

Washington Office
P.O. Box 96090
Room 906, Rosslyn Plaza East
Washington, DC 20090-6090
(703) 235 2730

Soil Conservation Service

Personnel Division
P.O. Box 2890
Washington, DC 20013
(202) 447 2631

DEPARTMENT OF COMMERCE

This arm of government, with 34,000 employees, has four regional "administrative support centers":

Personnel Officer
Eastern Administrative Support
Center
253 Monticello Ave.
Norfolk, VA 23510
(804) 441 6516

Personnel Officer
Central Administrative Support
Center
601 East 12th St.
Kansas City, MO 64106
(816) 758 2056

Personnel Officer
Mountain Administrative Support
Center
325 Broadway
Boulder, CO 80303
(303) 497 6306

Personnel Officer
Western Administrative Support
Center
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115
(206) 526 6054

Bureau of the Census

Personnel Division
Room 3254, Building Three
Washington, DC 20233
(301) 763 5780

National Institute of Standards and Technology

Personnel Officer
Room A-123, Administration
Building
Gaithersburg, MD 20899
(301) 975 3008

National Oceanic and Atmospheric Administration

Personnel Division
6010 Executive Blvd.
WSC #5, Room 706
Washington, DC 20852
(301) 443 8834

DEPARTMENT OF DEFENSE
DEPARTMENT OF THE ARMY

Army Corps of Engineers

Civilian Personnel Division
ATTN: CEPE-CS
20 Massachusetts Ave., NW
Room 5105
Washington, DC 20314-1000
(202) 272 0720

DEPARTMENT OF ENERGY

Headquarters Operations Division
Room 4E-090
1000 Independence Ave., SW
Washington, DC 20585
(202) 586 8536

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

OASH Personnel Operations Office
5600 Fishers Lane
Room 17A-08
Rockville, MD 20857
(301) 443 6900

Agency for Toxic Substances and Disease Registry

Personnel Office
1600 Clifton Rd., NE
Atlanta, GA 30333
(404) 639 3615

Centers for Disease Control

Personnel Office
1600 Clifton Rd., NE
Atlanta, GA 30333
(404) 639 3615

Food and Drug Administration

Division of Personnel Management
5600 Fishers Lane
Room 4B-41
Rockville, MD 20857
(301) 443 1970

National Institutes of Health National Institute of Environmental Health

Division of Personnel Management
9000 Rockville Pike
Bldg. 31, Room B3C15
Bethesda, MD 20205
(301) 496 2403

DEPARTMENT OF THE INTERIOR

Personnel Office
Office of the Secretary
Washington, DC 20240
(202) 343 6618

Bureau of Land Management

Division of Personnel
18th and C Sts., NW (MIB)
Washington, DC 20240
(202) 343 3193

Bureau of Mines

Headquarters
2401 E St., NW
Washington, DC 20241
(202) 634 4710

Bureau of Reclamation

Headquarters
18th and C Sts., NW
Washington, DC 20240
(202) 343 4626

National Parks Service

Headquarters
Branch of Personnel Operations
18th and C Sts., NW
P.O. Box 37127
Washington, DC 20013
(202) 343 4648

U.S. Fish and Wildlife Service

Headquarters
18th and C Sts., NW
Washington, DC 20240
(202) 343 6104

U.S. Geological Survey

National Center, MS-215
12201 Sunrise Valley Dr.
Reston, VA 22092
(703) 860 6127

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

Office of Personnel Management
Frances Perkins Bldg., Room N3308
200 Constitution Ave., NW
Washington, DC 20210
(202) 523 8013

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Headquarters, DP
Washington, DC 20546
(202) 453 8480

NATIONAL SCIENCE FOUNDATION

Staffing Assistant
Division of Personnel and
Management
1800 G St., NW, Room 208
Washington, DC 20550
(202) 357 9529

NUCLEAR REGULATORY COMMISSION

College Recruitment Coordinator
Office of Personnel
Washington, DC 20555
(301) 492 9027

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Articles

Although the following articles will be dated very quickly, they provided helpful insight in completing background research for the proposed application for environmental technology.

Borchardt, John K., "Laboratory Technicians Break Career Barriers,"Today's Chemist at Work, American Chemical Society, Washington, D.C., September 1993, pp. 51-53.

Clemmitt, Marcia, "Environmental Science Job Prospects Healthier Than Other Disciplines," The Scientist, The Scientist, Inc, Philadelphia, Pennsylvania, April 19, 1993, pp. 6-8.

D'Arcy, Karen and Bobby Lathan, "In-House Technicians Training Program, Journal of Chemical Education," Journal of Chemical Education; Software Special Issue Series, Springfield, Pennsylvania, Vol. 70, Number 12, December 1993, pp. 1010-1012.

Lucas, Charlotte Anne, "Man in the middle state's watchdog for environment faces tough job," The Dallas Morning News, Dallas, Texas, June 9, 1991, p. 12.

Manzo, Kathleen Kennedy, "Community Colleges Form Vanguard For New Environmental Training," Community College Week, Cox, Matthews & Associates, Inc., Fairfax, Virginia, April 11, 1994, pp. 8-9.

Totty, Michael, "Have All Those 'Green' Laws Helped?," The Wall Street Journal, Dow Jones & Company, Inc., New York, New York, June 29, 1994, pp. T1, T4.

Environmental firms clean up

The 'greening' of Texas business

Expanding public and private efforts to remedy America's environmental problems and to prevent or control future pollution are producing dollars-and-cents benefits for a number of Texas firms.

Stricter laws and regulations, as well as rising public awareness of environmental issues, are forcing major industrial companies to spend hundreds of millions on anti-pollution products and services. These trends have created a lucrative market for a wide variety of companies. Businesses such as solid and hazardous waste management companies, makers of air pollution control and water purification equipment and recycling firms are finding that going "green" can be profitable.

The environmental industry's largest segment is solid waste management, with 1990 revenues of $28.6 billion.

Industry snapshot: The environmental industry is growing rapidly, but the common definitions and statistics needed to describe the industry are only now emerging. Government agencies do not yet systematically compile data on such businesses, but private studies have begun to gather the information needed to provide a statistical snapshot of the major types of environmental companies.

One recent research effort by the trade newsletter *Environmental Business Journal (EBJ)* developed a profile of the U.S. environmental industry including more than 61,600 companies with combined annual revenues of nearly $132 billion in 1990. *EBJ* reported that privately owned companies generated about 65 percent of those revenues, while publicly traded firms accounted for 35 percent. Of the $45.8 billion in revenue received by public companies, 22 Texas firms accounted for 13 percent or $5.9 billion of the total. Detailed information on private Texas firms—which tend to be smaller but much more numerous—is not available, but literally hundreds of Texas public and private companies and governmental entities produce some environmental products and services.

Texas companies: The *EBJ* survey indicated that the environmental industry's largest segment is solid waste management, with 1990 revenues of $28.6 billion. Three large publicly traded firms accounted for 38 percent of the market; one of these was a Texas firm, with revenues of $3.1 billion in 1990.

The second-largest industry sector was resource recovery, including both industrial and consumer recycling and the rapidly emerging chemical recycling business. Resource recovery companies accounted for about 13 percent of 1990 industry revenues, or $17.2 billion. Of this, two Texas public companies together generated nearly $1.3 billion or roughly 7 percent of the total.

Water infrastructure companies—suppliers of equipment and services for water and wastewater treatment and delivery—brought in 1990 revenues of $14 billion. Just one Texas public firm made the list, with 1990 revenues of $33.8 million.

Hazardous waste management, a particularly fast-growing field due to increased government and private spending on cleanup projects, enjoyed 1990 revenues of $13.3 billion. Six Texas public companies working in the field generated $566.1 million of that amount.

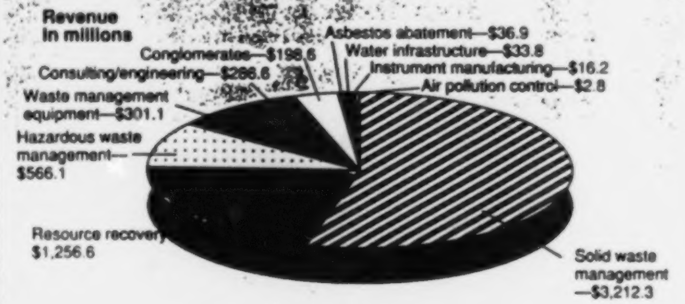
Environmental consulting and engineering firms have been boosted by federal clean water and air legislation; revenues for the field reached $12.2 billion in 1991. One publicly traded Texas firm contributed $286.6 million of the total.

Another large industry segment, waste management equipment, includes companies making water treatment equipment, catalytic convertors, landfill liners, protective suits and masks and even computer software used in environmental fields. Makers of such equipment generated $9.2 billion in 1990 revenue, with three Texas public firms accounting for $301.1 million of that.

Companies providing air pollution prevention devices and services represent a relatively small but growing branch of the

Environmental companies rub out pollution

According to the *Environmental Business Journal*, Texas' publicly traded firms had revenues of more than $5.9 billion from environmental products and services in 1990.



SOURCES: *Environmental Business Journal* and John Sharp, Comptroller of Public Accounts

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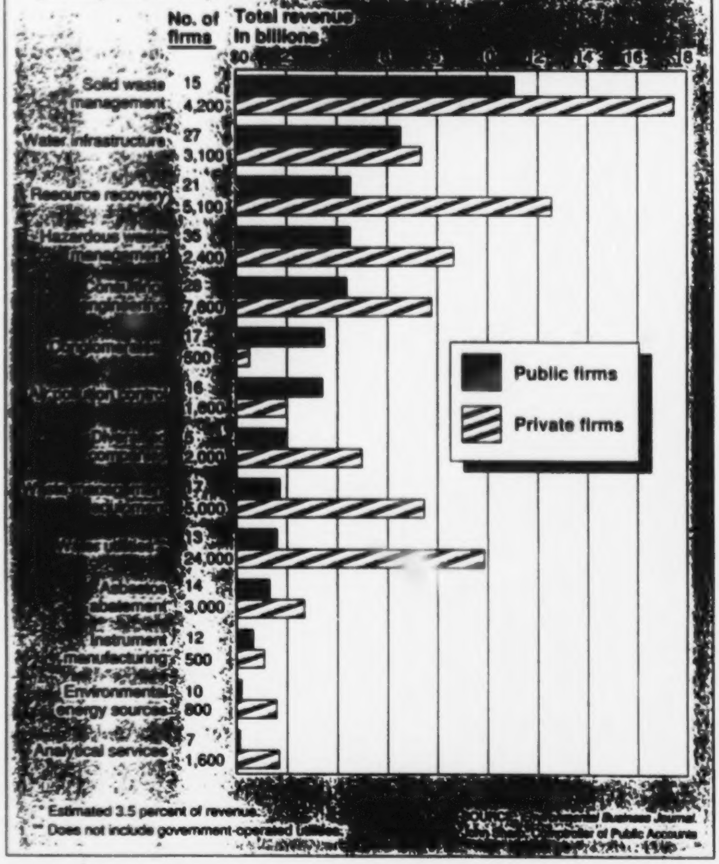
U.S. environmental industry, 1990

The *Environmental Business Journal* figures show the solid waste management sector leading the environmental industry with 1990 revenues of $28.6 billion. Of this total, 15 publicly traded firms accounted for $11 billion while 4,200 privately owned companies brought in about $17.5 billion.



* Estimated 3.5 percent of revenue.
** Does not include government-operated utilities.

Source: [illegible] Business Journal; [illegible] Comptroller of Public Accounts

Environmental consulting and engineering firms are expected to enjoy extremely fast growth in revenues, with many new business opportunities arising.

industry, with 1990 revenues of $5.4 billion. This count includes one Texas public company with revenues of $2.8 million.

Two other relatively small industry sectors are asbestos abatement companies, which remove the dangerous substance from existing buildings and structures, and manufacturers of environmental monitoring and other equipment. These sectors accounted for total nationwide 1990 revenues of $4 billion and $1.8 billion respectively. Two Texas public asbestos abatement companies generated $36.9 million of this, while one Texas instrument company accounted for $16.2 million.

Finally, *EBJ* reports that large conglomerate companies are playing a growing part in the environmental industry, with expansions of existing environmental operations and the creation of new environmental divisions. The *EBJ* survey assumed that about 3.5 percent of these companies' business is related to the environment, for about $4 billion in 1990 revenue. Using this yardstick, two Texas public conglomerates in the survey generated nearly $199 million in environmental revenues in 1990.

Industry outlook: Many industry analysts believe that the market for environmental products and services is relatively recession-resistant because the industry is in large part driven by government regulation rather than economic factors. While some companies were affected by the recent national recession, future prospects for the industry seem bright.

EBJ estimates that the environmental business market will grow by a vigorous 11 percent annually through 1996, with some industry sectors surpassing even this growth rate.

Environmental consulting and engineering firms are expected to enjoy extremely fast growth in revenues, with many new business opportunities springing from increasingly complex environmental regulations at the federal, state and local levels. *EBJ* estimates revenues for such firms will rise by 16 percent annually through 1996.

Air pollution control companies also will experience a 16-percent annual growth rate. Passage of the 1990 Clean Air Act amendments should dramatically boost sales for a wide variety of air pollution devices and services.

Revenues from resource recovery are projected to rise by 15 percent annually. This increase will result primarily from increased consumer recycling spurred by a rising number of state and local recycling programs and mandatory recycling laws, and by expected reductions in nationwide landfill capacity.

Hazardous waste will be another growth field, with 14-percent annual revenue increases through 1996. Hazardous waste firms will benefit from higher spending on private site cleanups and federal Superfund programs as well as other cleanups at various federal facilities and on thousands of leaking underground storage tanks. ★

Contributing to this article:
Maria Mendez-Lewis

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Accepting the 'Green' Challenge

When it comes to environmental compliance, some Texas firms choose to lead, not follow

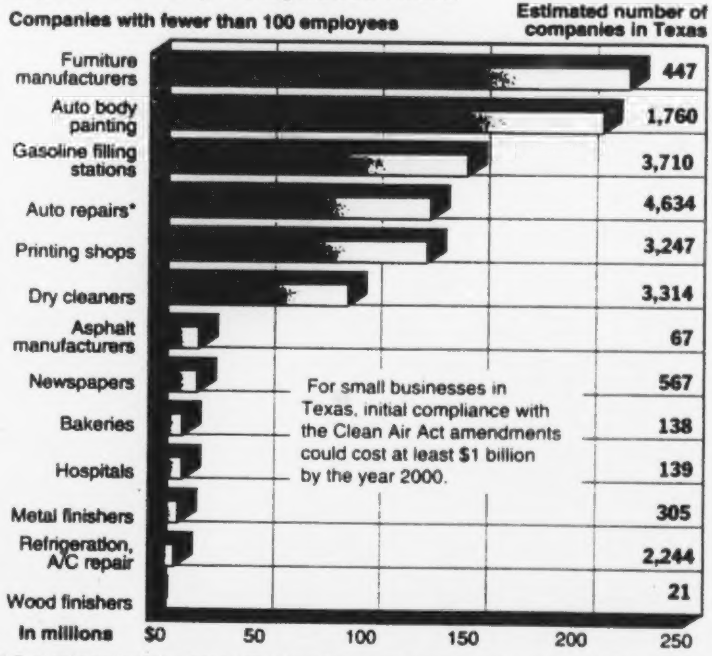
Realizing that reducing waste can mean polluting less, many Texas companies have decided that innovation and environmental regulation are compatible business partners.

In the 1990s, private industry faces an unprecedented economic challenge due to new regulations stemming from the federal Clear Air Act. For small businesses in Texas, initial compliance will run at least $1 billion, according to the Texas Natural Resource Conservation Commission (TNRCC).

The Clean Air Act, the most stringent environmental law ever passed in the U.S., requires all states to develop plans for meeting national air quality standards. Failure to meet these standards by specified dates between 1996 and 2007 could result in the loss of federal highway funds, growth limitations on industrial facilities or federal takeover of a state's planning process.

According to the TNRCC, Texas is "well ahead" of most states in meeting federal clean air standards. That's due, in part, to a host of Texas companies that have faced up to the environmental challenge and initiated cleaner processes before federal law mandates doing so.

Typical industry compliance costs



For small businesses in Texas, initial compliance with the Clean Air Act amendments could cost at least $1 billion by the year 2000.

* Cost estimate includes $32.4 million for volatile organic compound controls and $99 million for paint booths at repair shops that also do auto body painting.

SOURCE: Texas Natural Resource Conservation Commission.

The long arm of the law: The 1990 amendments to the Clean Air Act spell sweeping changes for private industry. Electric utilities, heavy industry, chemical and petroleum refining plants, coal mines and iron and steel making operations must obtain permits to release air pollutants. The broader law also affects many small businesses that previously were exempt. Compliance costs affecting gasoline stations, auto repair shops, dry cleaners, printers, bakeries and the like will be driven by far-reaching mandates involving purchases of services and specialty equipment. Services range from consultants to clean-up personnel. Specialty equipment includes emission reduction add-ons and new or alternative equipment used to reduce emissions at the source.

Already, fines in the tens of millions of dollars have been issued for non-compliance. State regulators say they want to recoup any economic benefit companies gained from skirting environmental laws.

Firms taking the initiative on compliance report that benefits often outweigh the increased expense. Many of these companies have been recognized by Clean Texas 2000, a statewide program sponsored by the Governor's Office and the TNRCC. The program en-

courages voluntary pollution reduction beyond state and federal requirements and seeks commitments that by 2000 Texas industrial facilities will have reduced by half the hazardous waste and/or emissions levels of 1987.

In response, operators of 114 industrial facilities in Texas have pledged pollution reductions that average 62 percent per facility, the TNRCC reports. If successful, this effort would reduce the amount of hazardous waste generated in Texas by 30 million tons and toxic emissions by 287 million pounds.

Many Texas firms have set targets well beyond government mandates.

The color of money: Companies adopting environmental improvements in the workplaces typically have been motivated by one or more key factors: the "green consumer" who looks for environmentally conscious products before opening his pocketbook, growing competitive pressures for greater productivity and increasingly strict environmental regulations. Many Texas firms have set targets well beyond government mandates. Here are just a few:

Fisher Controls International Inc. Ten years ago, this North Texas manufacturer of control valves launched a program to eliminate all toxic discharges from its plants by 1995. The McKinney plant assembled an environmental team to make sure the plant's 370 employees knew about changes in environmental regulations, then it continued to explore ways to reduce or eliminate pollution and waste. In 1993, the company spent $450,000 on its pollution-reduction goal.

So far, Fisher estimates it has reduced waste by 95 percent and diverted 1,600 tons of waste from landfills each year. The company no longer uses ozone-destroying paint solvents, thereby avoiding the release of 25 tons of toxic emissions into the air each year. These changes save the company $780,000 per year in disposal costs.

Fisher Controls was recognized with a Clean Texas 2000 Governor's Award for Environmental Excellence in 1993 for exemplary leadership to improve and protect the environment.

Houston Zoological Gardens. This world-class zoo faces different pollution challenges from those of most employers. The zoo, located near downtown Houston and the Texas Medical Center, lies amidst heavily used traffic patterns. Therefore, air pollution is a primary concern for zookeepers. Birds, for example, are highly sensitive to poor air quality, so the zoo has made aggressive use of specialized filters to maintain indoor air quality. At one time, the pesticides and other chemicals used on the zoo's spacious lawns and gardens were a source of pollution, but by switching to organic gardening, zoo managers say they all but eliminated this problem.

Chem-Pruf Door Co. This small Brownsville manufacturer of industrial fiberglass doors has devised a process to recover 90 percent of waste generated during the manufacturing process. Chem-Pruf designs and produces specialty doors, door frames and louvers for industrial facilities subjected to highly corrosive environments. The excess "dust" from the cutting, grinding and sanding of the fiberglass and excess bonding material are now captured and reused in making door frames. Recycling this material is cheaper than buying new resin filler, the company reports.

Chem-Pruf received a Clean Texas 2000 Governor's Award for Environmental Excellence in 1994 for exemplary leadership to improve and protect the environment.

Air pollution control costs

Due to new regulations, many small businesses are having to install emissions reduction equipment to comply with the Clean Air Act.

Companies with fewer than 100 employees	Range of equipment purchases
Asphalt manufacturers	$250,000 — $500,000
Auto body painting	$60,000 — $180,000
Auto repairs*	$5,000 — $8,000
Bakeries	$75,000 — $150,000
Dry cleaners	$21,000 — $42,000
Furniture manufacturers	$400,000 — $600,000
Gasoline filling stations	$30,000 — $40,000
Hospitals	$50,000 — $150,000
Metal finishers	$30,000 — $50,000
Printing/publishing/newspapers	$30,000 — $50,000
Refrigeration, A/C repair	$5,000 — $8,000
Wood finishers	$30,000 — $50,000

*Additional costs will be incurred by repair shops that apply auto body paint.
SOURCE: Texas Natural Resource Conservation Commission

Arrowhead Mills. Recognized as one of the country's leaders in organically-grown products, this 34-year-old West Texas company grows and produces grains, beans, seeds, hot and cold cereals, flours, rice dishes and soup mixes, oils and biscuit and cornbread mix—all without use of chemical pesticides or fertilizers.

According to Boyd Foster, president of Arrowhead Mills in Hereford, organic farming methods are an attempt "to work with Mother Nature rather than to work against her." The company recognizes that soil can regenerate itself if decaying organic matter is applied and that many harmful insects can be controlled by beneficial insects. Chemicals, when applied to the soil or growing crops tend to disrupt the natural order, Foster said, so mechanical methods are used to control weeds, thereby

Environment 101

Growth of the hazardous waste and environmental cleanup business in Texas and elsewhere has increased demand for skilled technicians. Many schools offer basic courses in these areas, but until 1993 Texas had no degree plan to qualify students as hazardous materials technicians.

Lamar University-Port Arthur has inaugurated a two-year program leading to an associate degree in hazardous materials technology. The basic curriculum was adapted to Southeast Texas, including the study of ecological conditions within coastal wetlands as well as surface water and land areas. Students learn about Texas environmental standards and Environmental Protection Agency (EPA) regulations. Class discussions focus on industrial and manufacturing processes using chemicals and energy sources throughout the state. Students visit hazardous waste operations and observe effective management practices. They also go to rivers, lakes and bayous to study ecological balances in nature and the potential dangers of hazardous materials.

Other Texas schools have responded to industry's challenge by planning programs in environmental technology. Among those are Brookhaven College in Farmers Branch near Dallas, Texas State Technical College in Harlingen, South Plains College in Lubbock; Amarillo College, Tyler Junior College, Palo Alto College in San Antonio and Paris Junior College.

Using federal research funds, universities also are working to develop environmental technologies. The Department of Defense has awarded Rice University a $19 million environmental research grant to create new technologies to clean up hazardous waste sites. Texas A&M University's Engineering Experiment Station has developed a less expensive but environmentally safe cooling process for air conditioners and refrigeration units. The University of Texas at El Paso is using $500,000 from EPA to research hazardous waste cleanup. ◘

avoiding damage to soil bacteria, earthworms and the natural decay of organic matter.

Arrowhead Mills has assisted the Texas Department of Agriculture in developing standards for the Texas organic certification program, which serves as a model for other states, and the company was a winner of the 1993 Clean Texas 2000 Governor's Award for Environmental Excellence.

Halliburton Energy Services Inc. This Houston manufacturer of oil field equipment routinely recycles residues from its metal working/fabrication shops. By using compressors, compactors and grinders, the company now recovers materials that it used to dispose of. Also, fluids used in the manufacturing process are captured for proper disposal, and that vastly reduces the potential for spills. Some of the facilities already recycle machining coolants, and the company is working on a plan to recycle the fluids at all its locations.

Halliburton now bales its wastepaper, which saves $1,000 a week in disposal fees. Recycling the polyurethane packaging used to prepare some products for shipping saves the company $300 per week in disposal fees.

E.I. Du Pont de Nemours & Co. Chemical companies, which typically produce half or more of all hazardous waste in industrial countries, have been among the most visible in formulating "green strategies." Du Pont in La Porte estimates it has reduced hazardous waste generation by nearly 20,000 tons since 1991 and cut toxic chemical releases by more than 3 million pounds, including reducing toxic air emissions by more than 90 percent. Du Pont, which won a 1994 Governor's Award for Environmental Excellence, expects these projects to save its La Porte agricultural and chemical manufacturing facility more than $10 million by 2000.

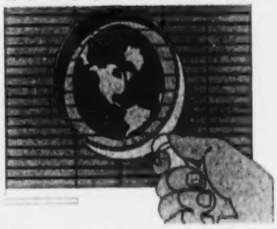
Cleaning up: While some Texas businesses have turned regulation into a positive bottom line with technology and more efficient processes, new "green industries" have sprung up in the face of stricter regulations, tapping into hundreds of millions of dollars that industrial companies have invested in anti-pollution products and services. Hazardous waste and environmental cleanup encompass a variety of endeavors that employ pollution-control equipment manufacturing, water and wastewater treatment systems and products, hazardous and solid waste management firms, environmental consultants, contracting and construction firms and law firms.

Management Information Services Inc. of Washington, D.C., estimates that the environmental industry had $170 billion in sales in 1992; of that, $10.5 billion was in Texas. Spending on environmental protection created 4 million jobs nationwide in 1992, including 270,000 in Texas.

The *Environmental Business Journal (EBJ)* surveyed more than 700 environmental companies in 12 industries. Four Texas companies ranked among *EBJ*'s top environmental engineering/consulting and contracting/construction firms: Radian Corp. of Austin, and TEAM Inc., M.W. Kellogg Co. and Brown and Root Inc., of Houston. ◘

Contributing to this article:
Leona Person, Mario Salinas
and Julie Crimmins

Some Texas businesses have turned regulation into a positive bottom line with technology and more efficient processes.



QUALITY WORKFORCE COUNCILS/SUMMARY

SAMPLE DOCUMENT
For
Reference Only

ENVIRONMENTAL TECHNOLOGY

PROGRAM APPROVAL REQUEST
submitted to the
TEXAS HIGHER EDUCATION
COORDINATING BOARD

DALLAS COUNTY COMMUNITY COLLEGE DISTRICT
BROOKHAVEN COLLEGE

Prepared by
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Submitted
August 1, 1994

PROGRAM SUMMARY

INSTITUTION: Brookhaven College of the Dallas County Community College District

REQUEST: Associates of Arts and Sciences Degree (AAS Degree) in Environmental Technology including program options for a Certificate and Advanced Skills Certificates

PROGRAM DESCRIPTION

Program Objectives: The program has been designed to provide the graduate with knowledge and skills necessary to function as an environmental technician. The program will emphasize knowledge and skills in the following areas: (1) testing and analysis of soil, air, and water and consumer product samples; (2) application of those techniques to ensure user and consumer safety, and (3) technical documentation and regulatory compliance.

Program Requirements: Cooperative work experiences at industry sites, combined with classroom and laboratory instruction comprise this 66 credit hour AAS Degree. It is a two year program reflective of an academic calendar based on semesters. Additionally, there will be a 33 credit hour certificate designed to produce a Laboratory Technician. Students who have completed the AAS Degree may pursue Advanced Skills Certificates in Laboratory Analysis and Regulatory Compliance.

NEED AND POTENTIAL

Occupational Need: Environmental Technology has been designated as an advanced technology program and as a priority for development by the Texas Higher Education Coordinating Board. The TINS Report, Interlink and other business publications in the field indicate a high demand (over 500 in Dallas County) for technicians through the year 2000.

The types of businesses in the community with a need to hire graduates from this program include: chemical and allied products manufacturers and blenders (cosmetics, pharmaceutical, adhesives, cleaners, etc.), electronics manufacturers, environmental laboratories, testing laboratories, environmental engineers, and governmental agencies such as the Bureau of Land Management, Bureau Standards, Housing and Urban Development, Environmental Protection Agency, and Transportation Agencies such as Dallas Area Rapid Transit (DART).

Existing Programs: Research reveals there are similar community college programs Texas. These programs are located at Texas State Technical College in Waco and at Midland, El Paso and Houston Community Colleges, Recently, programs at Texas State Technical College in Harlingen and Beeville Community Colleges were approved by the Coordinating Board. It is important to note that because of their locations, the above environmental programs target different industries. Most of these programs are geared to train technicians for petroleum and hazardous materials management and disposal. The DCCCD program will focus on training individuals to perform tests for the detection of contaminants in soil, air, water, and consumer products.

Expected Enrollment: Brookhaven College projects an initial enrollment of 15 students with a projected enrollment of 15 to 20 students per semester. Sixty to 80 students could be enrolled at any one time in various parts of the program. After its start-up period, it is expected the graduation rate will be 10 to 12 graduates per year.

Courses: Implementation of this program requires the development of 12 new courses. Four of these will be advanced courses developed to provide instruction for the students who are graduates with an AAS Degree and who are seeking additional skills and certification for the work place.

Faculty: The proposed program will begin with one full-time faculty member who will coordinate the program. During the initial stages of the program, this person will teach introductory courses and will also be responsible for marketing the program, making community contacts, arranging cooperative work experiences sites with local industry, etc. Other Environmental Technology courses will be taught by adjunct faculty from local industry, businesses, consulting firms, laboratories, and schools.

Facilities and Equipment: The existing classrooms and laboratories at Brookhaven College are sufficient for the program. The college has committed to a schedule for acquiring the additional equipment need to conduct this program in a quality manner.

SAMPLE PROGRAM APPLICATION

BROOKHAVEN COLLEGE

FICE CODE: 029150

ENVIRONMENTAL TECHNOLOGY

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Texas Higher Education Coordinating Board

APPLICATION FOR APPROVAL OF NEW TECHNICAL EDUCATION PROGRAMS

APPLICATION CHECKLIST

After a letter of intent has been submitted, an institution applying for a new technical education program must include all of the following items in its application packet. This completed checklist should also be included.

FORMS:

X	NEW-A	Application form
X	NEW-B	Statement of assurance of certificate standards
X	NEW-C	Courses to be included in the proposed program
N/A	NEW-D	Application for approval of related instruction courses
X	NEW-E	Course descriptions

REQUIRED ATTACHMENTS:

X Program summary (see Appendix A for instructions and sample summaries)

X Program development information, including

  - X Documentation of work-force demand
  - X Enrollment management plan
  - X Linkages and demonstration of non-duplication
  - X Advisory committee minutes
  - X Resources required
  - X Private sector involvement
  - X External agency approval, certification and accreditation

X Curriculum design, including

  - X Description of occupational competencies
  - X Proposed curriculum outline (see Appendix B for instructions and an example)

Applicants for Tech-Prep programs should also complete and submit those items included on the Tech-Prep checklist on the next page.

Texas Higher Education Coordinating Board

APPROVAL FOR APPROVAL OF NEW TECHNICAL PROGRAMS

APPLICATION FORM

1. Brookhaven College — Institution; 029150 — FICE Code; HEGIS Code: ______

2. PROPOSED PROGRAM

Indicate program location(s): Main campus X; Out-of-district ______

Off-campus ______; Correctional facility ______

	Length Wks/Sems /Quarters	Total Contact Hours	Total Credit Hours	CIP Code
A. Degree title: Environmental Technology	4 sem.	1,696	66	
Degree options, if any:				
AAS Environmental Technology				
Certificates, if any:				
Laboratory Assistant	2 sem.	896	33	

B. X Check here if this is Advanced/~~Tech Prep~~ program

C. Certificate title:				
Other certificates/options, if any:				
Laboratory Analysis	1 sem.	256	8	
Regulatory Compliance	1 sem.	96	6	

D. X Check if the program will be subject to the Guaranteed Graduate Policy.

Form NEW-A

3. PROPOSED IMPLEMENTATION DATE OF PROGRAM: January, 19 95

FOR TECH-PREP -- SECONDARY IMPLEMENTATION DATE(S): ______, 19__

FOR TECH-PREP -- COLLEGE IMPLEMENTATION DATE: ______, 19__

4. DATE OF GOVERNING BOARD APPROVAL: July 5, 19 94

5. Jack E. Stone Authorized School Official Signature (name and title)	7/27/94 Date	(214) 746-2445 Telephone	(214) 746-2039 FAX
President or CEO (name and title)	7-27-94 Date	(214) 620-4809 Telephone	(214) 620-4897 FAX

Please note that this form should also be accompanied by forms NEW-B through NEW-E as well as required attachments.

For Coordinating Board Use Only

( ) Approved
( ) Approved with provision (describe details on separate page)
( ) Disapproved

Staff review by

Approved by Assistant Commissioner
Community and Technical Colleges Division

Date

Texas Higher Education Coordinating Board

APPLICATION FOR APPROVAL OF NEW TECHNICAL PROGRAMS

ASSURANCE OF CERTIFICATE STANDARDS

Students pursuing certificate programs approved by the Coordinating Board will be required to meet competency-based technical skills and proficiencies in the three basic foundation skills and five work-place competencies as defined in *A SCANS Report for America 2000*, published by the U.S. Department of Labor in June 1991. For further information on this, see pages 10-11 of the *Guidelines*.

In the space below, provide an institutional assurance that the certificate program, if approved by the Coordinating Board, will meet the above proficiency requirements.

SCANS competencies and foundation skills have been incorporated into the courses for this program. Nowhere is it more important for workplace competencies to be actively taught than in a technology program, where it is essential for students to leave the classroom prepared to enter the work world. This program will utilize the following activities to demonstrate the incorporation of SCANS into the courses:

1. Through the use of the local advisory committee, industry standards for levels of workplace performance were established. Graduates must be performing at these levels upon completing the program. (Appendix A)
2. The curriculum, classroom, and instructional activities are designed to be SCANS based. A sample outline of courses and SCANS based activities can be found in Appendix B.
3. Student performance, assessment, and evaluation will be used to document achievement of SCANS competencies. See Appendix C for sample evaluation form.

Form NEW-B

Funding		Course Prefix	Course Number	FICE Code: 029150	Hours (must be whole numbers)				Type of Instruction*
Tech Voc	Gen Acad			Course Title	Lecture	Lab	Contact	Credit	
NEW COURSES TO BE INCLUDED IN THE PROGRAM AND COURSE INVENTORY									
X		ENV	101	Introduction to Environmental Science and Safety	2	3	80	3	1 and 2
X		ENV	102	Documentation Techniques	2	3	80	3	1 and 2
X		ENV	105	Chemical Processes	3	3	96	4	1 and 2
X		ENV	106	Calculations for Environmental Technology	2	0	32	2	1
X		ENV	201	Field Sampling and Testing	2	6	128	4	1 and 2
X		ENV	202	Hazardous Materials	3	0	48	3	1
X		ENV	206	Industrial Processes and Procedures	3	0	48	3	1
X		ENV	207	Environmental Laboratory Instrumentation	2	6	128	4	1 and 2
X		ENV	208	Extraction and Analysis of Materials	2	6	128	4	1 and 2
X		ENV	209	Interpreting Government Regulations	3	0	48	3	1
X		ENV	210	Employee Right-to-Know Programs	3	0	48	3	1
X		ENV	703	Cooperative Work Experience	1	15	256	3	5
CURRENTLY APPROVED COURSES TO BE INCLUDED IN THE PROGRAM									

* Types of instruction: 1 = lecture, 2 = lab, 3 = clinical, 4 = televised instruction, 5 = co-op, 8 = apprenticeship
(please duplicate this form as needed)

Form NEW-C

Funding		Course Prefix	Course Number	FICE Code: 029150	Hours (must be whole numbers)				Type of Instruction*
Tech Voc	Gen Acad			Course Title	Lecture	Lab	Contact	Credit	
NEW COURSES TO BE INCLUDED IN THE PROGRAM AND COURSE INVENTORY									
CURRENTLY APPROVED COURSES TO BE INCLUDED IN THE PROGRAM									
	X	CHM	101	General Chemistry	3	3	96	4	1 and 2
	X	ENG	101	Composition I	3	0	48	3	1
	X	MTH	101	College Algebra	3	0	48	3	1
	X	CHM	102	General Chemistry	3	3	96	4	1 and 2
	X	BIO	223	Environmental Biology	3	3	96	3	1 and 2
	X	SC	101	Introduction to Speech Communication	3	0	48	3	1
X		CMT	124	Electrical and Mechanical Equipment	3	3	96	4	1 and 2
	X	CHM	203	Quantitative Analysis	2	6	128	4	1 and 2
	X	CHM	234	Instrumental Analysis	2	6	128	4	1 and 2

* Types of instruction: 1 = lecture, 2 = lab, 3 = clinical, 4 = televised instruction, 5 = co-op, 8 = apprenticeship
(please duplicate this form as needed)

Form NEW-C

Texas Higher Education Coordinating Board

APPLICATION FOR APPROVAL OF NEW TECHNICAL EDUCATION PROGRAMS

COURSE DESCRIPTIONS
(duplicate as needed)

Institution: Brookhaven College FICE Code: 029150

Program: Environmental Technology

BIO 223 Environmental Biology (3)
The principles of aquatic and terrestrial communities are presented. Emphasis is on the relationship of these principles to the problems facing people in a modern technological society. Laboratory fee. (3 Lec., 3 Lab.)

CHM 101 General Chemistry (4)
Prerequisites: Developmental Mathematics 093 or equivalent and any one of the following: high school chemistry, Chemistry 115, or the equivalent. Fundamental concepts of chemistry are presented including states and properties of matter, the periodic table, chemical reaction types and energy relationships, chemical bonding, atomic and molecular structure, stoichiometry, gas laws and solutions. (3 Lec., 3 Lab.)

CHM 102 General Chemistry (4)
Prerequisite: CHM 101. Continuation of CHM 101. Previously learned and new concepts are applied. Topics include reaction kinetics and chemical equilibrium, acids, bases, salts and buffers, thermodynamics, colligative properties of solutions, electrochemistry, transition-metal chemistry, nuclear chemistry, qualitative inorganic analysis and an introduction to organic chemistry. (3 Lec., 3 Lab.)

CHM 203 Quantitative Analysis (4)
Prerequisites: CHM 102 and MTH 101. A survey of methods used in analytical chemistry: gravimetric and volumetric methods based on equilibria, oxidation-reduction, and acid-base theory, spectrophotometry, chromatography, and electroanalytical chemistry. (2 Lec., 6 Lab.)

CHM 234 Instrumental Analysis (4)
Prerequisites: Chemistry 203 or demonstrated competence approved by the instructor. The role of modern electronic instrumentation in analysis is explored. Topics include infrared and ultraviolet spectroscopy, gas chromatography, potentiometric titration, electrochemistry, continuous flow analysis, scintillation counting, electrophoresis, flame photometry, and atomic absorption spectrophotometry as analytical tools.
(2 Lec., 6 Lab.)

CMT 124 Electrical and Mechanical Equipment (4)
The nature and use of materials and equipment in various systems are explained. Included are plumbing, heating, ventilation, air conditioning, electrical, and conveying systems. (3 Lec., 3 Lab.)

Texas Higher Education Coordinating Board

APPLICATION FOR APPROVAL OF NEW TECHNICAL EDUCATION PROGRAMS

COURSE DESCRIPTIONS
(duplicate as needed)

Institution: Brookhaven College FICE Code: 029150

Program: Environmental Technology

ENG 101 Composition I (3)
Prerequisite: An appropriate assessment test score (ACT, DCCCD test, or SAT). This course focuses on student writing. It emphasizes reading and analytical thinking and introduces research skills. Students practice writing for a variety of audiences and purposes. (3 Lec.)

* **ENV 101 Introduction to Environmental Science and Safety (3)**
Prerequisites: High school chemistry or Chemistry 115; Developmental Math 093 or equivalent. This course is an introduction to environmental technology. Topics covered include fundamental concepts and considerations of environmental chemicals, including sources and remediation of pollution and contamination of air, water, soil, and consumer products, and an introduction to basic safety practices and procedures. (2 Lec., 3 Lab.)

* **ENV 102 Documentation Techniques (3)**
Prerequisites: ENV 101 and CHM 101. This course provides the fundamentals of field and laboratory record-keeping, documentation procedures, and basic report writing using the computer. (2 Lec., 3 Lab.)

* **ENV 105 Chemical Processes (4)**
Prerequisite: CHM 101. This course provides instruction on chemical processes. Topics include a survey of organic and biochemical reactions, syntheses, nomenclature, uses and purposes and properties of the important classes of organic and biochemical compounds, fundamental biochemical pathways and molecules, and microbial processes and procedures. (3 Lec., 3 Lab.)

* **ENV 106 Calculations for Environmental Technology (2)**
Prerequisites: CHM 101 and MTH 101. This course combines applications of math skills and chemical knowledge for solving problems in the environment. Topics include calculation of concentrations in split and diluted samples, simple statistical analysis, methods for determination of number of control and collected samples, control chart construction, calculations for reagent and standards preparation, and calculations for microbial testing. (2 Lec.)

* DENOTES NEW COURSES

Form NEW-E

Texas Higher Education Coordinating Board

APPLICATION FOR APPROVAL OF NEW TECHNICAL EDUCATION PROGRAMS

COURSE DESCRIPTIONS
(duplicate as needed)

Institution: Brookhaven College FICE Code: 029150

Program: Environmental Technology

---

* **ENV 201 Field Sampling and Testing (4)**
Prerequisite: CHM 203. This course provides instruction on sampling and testing procedures for environmental problems in air, soil, water, and product contamination. Topics include sample selection, collection, treatment, testing, storage, packing and shipping, data collection, and interface with computer analytical systems. (2 Lec., 6 Lab.)

* **ENV 202 Hazardous Materials (3)**
Prerequisites: CHM 102 and ENV 102. This course provides an in-depth study of hazardous materials, including modes of action, appropriate documentation, handling procedures, waste classification and disposal. (3 Lec.)

* **ENV 206 Industrial Processes and Procedures (3)**
Prerequisites: CHM 102 and ENV 102. This course provides an overview of industrial chemical processes. Topics include catalytic cracking, hydrogenation, ethoxylation, sulfonation, and distillation and desalting. (3 Lec.)

* **ENV 207 Environmental Laboratory Instrumentation (4)**
Prerequisite: AAS in Environmental Technology. This course provides calibration, maintenance, and troubleshooting of instrumentation used for analysis. Topics include atomic absorption, gas chromatography, ultraviolet/visible spectroscopy, high performance liquid chromatography, Fourier Transform infrared spectrometry, light microscope, protective gear, use of computer interfaces, and an introduction to quality control procedures, including instrument checks. (2 Lec., 6 Lab.)

* **ENV 208 Extraction and Analysis of Materials (4)**
Prerequisite: AAS in Environmental Technology. This course provides methods for extraction of analytes from complex matrices for instrumental analysis (2 Lec., 6 Lab.)

* **ENV 209 Interpreting Government Regulations (3)**
Prerequisite: AAS in Environmental Technology. This course presents a summary of regulations which impact environmental technology from various government agencies (3 Lec.)

* DENOTES NEW COURSES

Form NEW-E

Texas Higher Education Coordinating Board

APPLICATION FOR APPROVAL OF NEW TECHNICAL EDUCATION PROGRAMS

COURSE DESCRIPTIONS
(duplicate as needed)

Institution: Brookhaven College FICE Code: 029150

Program: Environmental Technology

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* **ENV 210 Employee Right-to-Know Programs (3)**
Prerequisite: AAS in Environmental Technology. This course provides instruction for the design and development of Employee Right-to-Know programs for use in environmental technology. (3 Lec.)

* **ENV 703 Cooperative Work Experience (3)**
Prerequisites: Completion of two courses in the Environmental Technology program or instructor approval. This course combines productive work experience with academic study. The student, employer, and instructor will develop a written competency-based learning plan with varied learning objectives and work experiences. Students must develop new learning objectives each semester. The semester consists of topics which include job interview and job application techniques, job site interpersonal relations, and employer expectations of employees. (1 Lec., 15 Lab.)

MTH 101 College Algebra (3)
Prerequisites: Two years of high school algebra and an appropriate assessment test score or Developmental Mathematics 093. This course is a study of relations and functions including polynomial, rational, exponential, logarithmic, and special functions. Other topics include variation, complex numbers, systems of equations and inequalities, theory of equations, progressions, the binomial theorem, proofs, and applications. (3 Lec.)

SC 101 Introduction to Speech Communication (3)
Theory and practice of speech communication behavior in one-to-one, small group, and public communication situations are introduced. Students learn more about themselves, improve skills in communicating with others, and make formal oral presentations. This course requires college-level skills in reading and writing. (3 Lec.)

* DENOTES NEW COURSES

Form NEW-E

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE: Introduction to Environmental Science and Safety

COURSE NUMBER: ENV 101

CREDIT HOURS: 3

CONTACT HOURS: 80

COURSE DESCRIPTION: Prerequisites: High school chemistry or Chemistry 115; Developmental Math 093 or equivalent. This course is an introduction to environmental technology. Topics covered include fundamental concepts and considerations of environmental chemicals, including sources and remediation of pollution and contamination of air, water, soil, and consumer products, and an introduction to basic safety practices and procedures. (2 Lec., 3 Lab.)

COURSE COMPETENCY: Identify sources of and remediation measures for air, soil, water, and product contamination; demonstrate and practice use of basic safety standards, measures, and use of equipment.

LEARNING OUTCOMES: The student must:

1. Demonstrate the use of lab/field safety guidelines.
2. Interpret safety and warning label information.
3. Review sources of air, soil, water, and product contamination.
4. Practice basic personal protective equipment use and care.
5. Demonstrate basic personal protective equipment use and care.
6. Practice basic laboratory safety procedures.
7. Demonstrate basic laboratory safety procedures.
8. Examine representative health and safety plans.
9. Interpret chain of custody procedures.
10. Interpret sample transportation requirements.
11. Describe waste classification, separation, recycling, treatment, storage, and disposal procedures.
12. Review laboratory documentation procedures.
13. Identify and use appropriate decision-making process to solve problems.
14. Prepare sample reports.

BROOKHAVEN COLLEGE **FICE CODE: 029150**

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE: Documentation Techniques

COURSE NUMBER: ENV 102

CREDIT HOURS: 3

CONTACT HOURS: 80

COURSE DESCRIPTION: Prerequisites: ENV 101 and CHM 101. This course provides the fundamentals of field and laboratory record-keeping, documentation procedures, and basic report writing using the computer. (2 Lec., 3 Lab.)

COURSE COMPETENCY: Apply basic word processing and data management knowledge and skills to create recordkeeping and documentation for sample standards and controls, shipping, chemical inventory, reagent preparation and use, equipment maintenance and use, and chain of custody.

LEARNING OUTCOMES: The student must:

1. Examine documentation procedures used within the industry.
2. Demonstrate application of basic computer skills and their use in environmental technology.
3. Develop documents used in the industry for records management purposes for reports, standards and reagents log, chemical inventory, instrument run and maintenance log, chain of custody, telephone log, records inventory, and waste storage and disposal.
4. Solve problems in environmental technology by designing a decision-making process or decision tree.
5. Prepare a safety sheet and warning label for hazardous material, using literature data.

BROOKHAVEN COLLEGE FICE CODE: 029150

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE: Chemical Processes

COURSE NUMBER: ENV 105

CREDIT HOURS: 4

CONTACT HOURS: 96

COURSE DESCRIPTION: Prerequisite: CHM 101. This course provides instruction on chemical processes. Topics include a survey of organic and biochemical reactions, syntheses, nomenclature, uses and purposes and properties of the important classes of organic and biochemical compounds, fundamental biochemical pathways and molecules, and microbial processes and procedures. (3 Lec., 3 Lab.)

COURSE COMPETENCY: Use biochemical and microbial processes to solve problems in environmental technology.

LEARNING OUTCOMES: The student must:

1. Examine major classes of organic and biochemical compounds.
2. Recognize important reactions of organic and biochemical compounds.
3. Review major biochemical pathways.
4. Identify major classes of microbiological organisms and their reactions.
5. Implement necessary control measures for sample or specimen analysis.
6. Prepare equipment, reagents and standards required for analytical procedures.
7. Prepare samples for analysis.
8. Perform analytical procedures for chemical reactions.
9. Perform microbiological procedures for culture analysis.
10. Calculate and analyze results of chemical, physical, or microbiological reactions.
11. Decide next-step action for the analytical process.

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE: Calculations for Environmental Technology

COURSE NUMBER: ENV 106

CREDIT HOURS: 2

CONTACT HOURS: 32

COURSE DESCRIPTION: Prerequisites: CHM 101 and MTH 101. This course combines application of math skills and chemical knowledge for solving problems in the environment. Topics include calculation of concentrations in split and diluted samples, simple statistical analysis, methods for determination of number of control and collected samples, control chart construction, calculations for reagent and standards preparation, and calculations for microbial testing. (2 Lec.)

COURSE COMPETENCY: Apply math skills and chemical knowledge to problems in environmental technology.

LEARNING OUTCOMES: The student must:

1. Analyze information and data for the purpose of mathematically solving complex word problems related to environmental situations.
2. Synthesize information and data situations.
3. Organize information and data situations.
4. Apply word problem-solving skills to applicable environmental technology situations.
5. Perform basic statistical analyses to problems related to environmental technology.

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE: Field Sampling and Testing

COURSE NUMBER: ENV 201

CREDIT HOURS: 4

CONTACT HOURS: 128

COURSE DESCRIPTION: Prerequisite: CHM 203. This course provides instruction on sampling and testing procedures for environmental problems in air, soil, water, and product contamination. Topics include sample selection, collection, treatment, testing, storage, packing and shipping, data collection, and interface with computer analytical systems. (2 Lec., 6 Lab.)

COURSE COMPETENCY: Apply laboratory procedures for field sampling and testing to problems and identifying solutions in environmental technology.

LEARNING OUTCOMES: The student must:

1. Apply lab/field safety guidelines.
2. Utilize personal protective equipment for field work.
3. Maintain field notebook.
4. Organize work load for field work.
5. Perform routine maintenance, calibration, and performance checks for field instrumentation and equipment.
6. Perform routine maintenance, calibration, and performance checks for personal protective equipment.
7. Document field sampling and sample preparation procedures.
8. Practice chain of custody procedures.
9. Clean and decontaminate equipment and protective gear before and after sampling.
10. Perform field measurements and tests.
11. Follow procedures for sample shipping, labeling, and transport.
12. Select and run appropriate control samples.
13. Interface field equipment with computer.

BROOKHAVEN COLLEGE

FICE CODE: 029150

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE:	Hazardous Materials
COURSE NUMBER:	ENV 202
CREDIT HOURS:	3
CONTACT HOURS:	48

COURSE DESCRIPTION: Prerequisites: CHM 102 and ENV 102. This course provides an in-depth study of hazardous materials, including modes of action, appropriate documentation, handling procedures, waste classification and disposal. (3 Lec.)

COURSE COMPETENCY: Identify and describe classes, regulatory requirements, and safety procedures for hazardous materials in environmental technology.

LEARNING OUTCOMES: The student must:

1. Review classes of hazardous materials.
2. Identify action of major classes of hazardous materials.
3. Identify disposal methods for major classes of hazardous materials.
4. Interpret lab/field safety guidelines with regard to hazardous materials.
5. Interpret safety and warning label information for major classes of hazardous materials.
6. Review personal protective equipment use and care, laboratory safety and chain of custody procedures, and sample transportation requirements.
7. Review waste classification, separation, recycling, treatment, storage, and disposal procedures.
8. Design a health and safety plan for handling hazardous materials.

BROOKHAVEN COLLEGE **FICE CODE: 029150**

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE: Industrial Processes and Procedures

COURSE NUMBER: ENV 206

CREDIT HOURS: 3

CONTACT HOURS: 48

COURSE DESCRIPTION: Prerequisites: CHM 102 and ENV 102. This course provides an overview of industrial chemical processes. Topics include catalytic cracking, hydrogenation, ethoxylation, sulfonation, and distillation and desalting. (3 Lec.)

COURSE COMPETENCY: Apply environmental guidelines and principles to industrial processes and procedures.

LEARNING OUTCOMES: The student must:

1. Examine industrial chemical processes.
2. Identify laboratory and field procedures used in industrial chemical processes.
3. Interpret components of safety procedures.
4. Compare representative safety policies.
5. Interpret components of chain of custody procedures.
6. Compare representative chain of custody policies.
7. Interpret documentation procedures for testing and analysis.
8. Compare representative documentation policies for testing and analysis.
9. Interpret sample and report tracking and storage procedures.
10. Compare representative sample and report tracking and storage policies.
11. Interpret shipping and transportation procedures.
12. Compare representative shipping and transportation policies.
13. Interpret quality assurance/quality control programs.
14. Compare representative quality assurance/quality control programs.
15. Interpret industrial procedures for waste handling, storage, and disposal.
16. Compare industrial procedures for waste handling, storage, and disposal.

BROOKHAVEN COLLEGE

FICE CODE: 029150

PROPOSED NEW COURSE DESCRIPTION FOR ADVANCED SKILLS CERTIFICATE

COURSE TITLE: Environmental Laboratory Instrumentation

COURSE NUMBER: ENV 207

CREDIT HOURS: 4

CONTACT HOURS: 128

COURSE DESCRIPTION: Prerequisite: AAS in Environmental Technology. This course provides calibration, maintenance, and troubleshooting of instrumentation used for analysis. Topics include atomic absorption, gas chromatography, ultraviolet/visible spectroscopy, high performance liquid chromatography, Fourier Transform infrared spectrometry, light microscope, protective gear, use of computer interfaces, and an introduction to quality control procedures, including instrument checks. (2 Lec., 6 Lab.)

COURSE COMPETENCY: Calibrate, maintain, and troubleshoot instrumentation used in environmental labs.

LEARNING OUTCOMES: The student must:

1. Perform routine maintenance and calibration procedures for laboratory instrumentation used in environmental technology.
2. Perform routine maintenance, calibration, and performance checks for personal protective equipment.
3. Reassemble dismantled instruments.
4. Troubleshoot malfunctioning instruments.
5. Monitor protective equipment and instrument operating ranges.
6. Perform instrument system suitability for procedures used in environmental technology.
7. Flowchart sample treatment, analysis, and controls for unknowns.
8. Perform software interface of instrumentation with computer.

PROPOSED NEW COURSE DESCRIPTION FOR ADVANCED SKILLS CERTIFICATE

COURSE TITLE: Extraction and Analysis of Materials

COURSE NUMBER: ENV 208

CREDIT HOURS: 4

CONTACT HOURS: 128

COURSE DESCRIPTION: Prerequisite: AAS in Environmental Technology. This course provides methods for extraction of analytes from complex matrices for instrumental analysis (2 Lec., 6 Lab.)

COURSE COMPETENCY: Extract and design analytes from complex matrices commonly encountered in problem solving in environmental technology.

LEARNING OUTCOMES: The student must:

1. Select appropriate methods of extraction for analyte in complex matrix.
2. Prepare analyte for analysis.
3. Select and analyze appropriate controls for analysis.
4. Report method of extraction and analysis.
5. Report level of analyte.

PROPOSED NEW COURSE DESCRIPTION FOR ADVANCED SKILLS CERTIFICATE

COURSE TITLE: Interpreting Government Regulations

COURSE NUMBER: ENV 209

CREDIT HOURS: 3

CONTACT HOURS: 48

COURSE DESCRIPTION: Prerequisite: AAS in Environmental Technology. This course presents a summary of regulations which impact environmental technology from various government agencies. (3 Lec.)

COURSE COMPETENCY: Identify and interpret Federal, State, and Local guidelines for environmental protection and control to demonstrate a knowledge of regulatory compliance for environmental problems.

LEARNING OUTCOMES: The student must:

1. Locate and identify resources which apply to environmental technology.
2. Review and interpret government guidelines for consumer protection and safety.
3. Review and interpret government guidelines for handling and disposal of hazardous materials.
4. Review and interpret government guidelines for environmental protection.

PROPOSED NEW COURSE DESCRIPTION FOR ADVANCED SKILLS CERTIFICATE

COURSE TITLE: Employee Right-to-Know Programs

COURSE NUMBER: ENV 210

CREDIT HOURS: 3

CONTACT HOURS: 48

COURSE DESCRIPTION: Prerequisite: AAS in Environmental Technology. This course provides instruction for the design and development of Employee Right-to-Know programs for use in environmental technology. (3 Lec.)

COURSE COMPETENCY: Design an Employee Right-to-Know program for an industrial workplace setting.

LEARNING OUTCOMES: The student must:

1. Review and interpret government guidelines for employee protection and safety.
2. Design a representative Employee Right-to-Know program.
3. Develop and produce an Employee Right-to-Know manual.

BROOKHAVEN COLLEGE FICE CODE: 029150

PROPOSED NEW COURSE DESCRIPTION

COURSE TITLE: Cooperative Work Experience

COURSE NUMBER: ENV 703

CREDIT HOURS: 3

CONTACT HOURS: 256

COURSE DESCRIPTION: Prerequisites: Completion of two courses in the Environmental Technology program or instructor approval. This course combines productive work experience with academic study. The student, employer, and instructor will develop a written competency-based learning plan with varied learning objectives and work experiences. Students must develop new learning objectives each semester. The semester consists of topics which include job interview and job application techniques, job site interpersonal relations, and employer expectations of employees. (1 Lec., 15 Lab.)

COURSE COMPETENCY: Apply chemical principles and laboratory and field skills within a work setting.

LEARNING OUTCOMES: The student must:

1. Identify employer expectations needed to function as a member of the work team.
2. Demonstrate performance in the work environment needed to be a valued worker.
3. Apply fundamental Environmental Technology skills and knowledge needed to succeed in the specific job area.

PROGRAM SUMMARY

The program proposed has been designed to provide the student with knowledge and skills necessary to function as an environmental technician. Emphasis in the program will be placed on knowledge and skills in the following areas: (1) testing and analysis of soil, air, water, and consumer product samples, (2) application of these techniques to ensure user and consumer safety, and (3) technical documentation and regulatory compliance.

This program's training and instruction will be conducted in 66 credit hours of instruction for the AAS degree. The program will, in two years, incorporate practical experience through the use of cooperative education with classroom instruction. The two years are reflective of an academic calendar based on semesters. Additionally, there will be a 33 credit hour certificate designed to train for a Laboratory Technician. Upon completion of the two-year degree, an individual may return to pursue Advanced Skills Certificates in Laboratory Analysis and Regulatory Compliance.

Indications from traditional federal, state, and local occupational data documents are non-existent for the occupational category of Environmental Technology. However, the Texas Innovation Network (TINS) has projected the area of environmental technology as an emerging occupation with a considerable number of openings for the state of Texas. Thus, the review and interpretation of the TINS data lead to the development of this proposal. Documentation highlighting the available information related to the emergence of environmental technology can be found in Appendix D.

Research revealed there are similar community college programs located in Texas. These programs are located at Midland, El Paso, and Houston Community Colleges. Additionally, there is a program in Waco, Texas operated by Texas State Technical College; and most recently, TSTC Harlingen and Beeville Community Colleges were approved by the Coordinating Board. It is important to note these programs target different industries because of their geographical location. Most of these programs are geared to train technicians for the petroleum and hazardous materials management and disposal. The DCCCD program will focus on training individuals to perform tests for the detection of contaminants in soil, air, water, and consumer products.

Individuals who successfully complete the two-year program will be awarded an associate of applied science degree and will have demonstrated knowledge and skills needed to enter the workforce. The employment sites for environmental technicians include large manufacturing companies, laboratories, quality assurance departments, agriculture industry, public utilities, hospitals, and other large and small businesses.

LABOR MARKET DEMAND

This program is designed for individuals to be employed with businesses and organizations responsible for collecting and testing soil, air, and water samples. The federal, state, and local employment data do not identify the occupational category of Environmental Technology as an official occupational listing at this time. However, according to the Technology and Emerging Occupations: Directions for Texas in the 1990's published by the Texas Department of Commerce, Work Force Development Division, as a result of research conducted by the Texas Innovation Network (TINS), this occupational category is emerging as a need to monitor and assist industries which are involved with various products impacted by chemical and contaminant factors ensure product safety for consumer protection.

The TINS 1988 report highlighted technology changes and relevant occupations which are expected to emerge within 10 years. Six groups of technologies were identified, of the six groups one was titled "Energy and Environment Technologies". Under this occupational category, the job title of Laboratory Analyst/Environmental is listed. During a phase of the TINS work, the job title of Laboratory Analyst/Environmental was changed to read Environmental Laboratory Technician. Thus, for the development of this program proposal, the person trained will be trained to serve as an Environmental Technician. Included in Appendix E are articles which further discuss the emerging trends of Environmental Technology.

Consequently, the area Quality Work Force Planning Committee has adopted the occupational category of Environmental Technology as a targeted occupation (Appendix F). The TINS report speculates there will be a need of 500 - 5,000 annual job openings throughout the state by 1995 (Appendix G).

To get a perspective on the Dallas labor market and the demand for an Environmental Technology program, a survey was conducted. The next section presents a summary of the findings of the survey.

SUMMARY OF EMPLOYER SURVEY

The survey (Appendix H) conducted as part of this program exploration was designed to collect data regarding need, salary, projected future position, and employer thoughts about education. The survey responses were tabulated using frequency responses and percentages (Appendix I). The occupational category of Environmental Technology is very broad. Almost every industry has a component of the business dedicated to the area of occupational health and safety services. This is particularly true for the manufacturing industry.

The survey sample was identified and selected using Standard Industrial Classification (SIC) codes. After the SIC codes were selected, the services of a business listing clearinghouse was used. A computer list was generated which contained addresses of 1,386 businesses. As a result of the method used to secure the sample size, it is accurate to say sampling technique used was targeted by industry category. A listing of the employers who received the survey can be found in Appendix J. An explanation of the SIC codes used can be found in Appendix K.

Of the surveys mailed 61 surveys were completed and returned, either by fax or the United States Postal Service. This represented a 4% return rate. No survey forms were returned by U.S. Postal Service. Therefore, it was assumed the mail was delivered as addressed. In Appendix L, a partial listing of the survey respondents, who provided names and addresses, can be viewed.

Twenty-five of the 61 respondents (42%) indicated their company had employees who were currently performing duties consistent with an Environmental Technician. Whereas, 34 or 58% of the organizations surveyed did not have such an employee. A question regarding the need for the proposed training in Environmental Technology was included on the survey. Forty-five (83%) of the respondents believed training at an Associate Degree level was needed with 9 or 17% saying "no" to the need for training. With regard to training at the certificate level, 74% of the respondents indicated the training proposed was a good idea and 26% did not.

The respondents reported hiring full-time considerations over the next 5 years for associate degree and certificate level would represent a total of 85 persons. The hiring considerations for part-time personnel with the respective levels of training would be a total of 70 persons.

The respondents considered the hourly salary range for a certificate level training person to be $6.00 - $12.00. With an annual salary of $14,560K - $30,000K. For an associate degree level person, the hourly rate was reported to be $7.00 - $15.00 and the annual as $18,000K - $50,000K.

While the completed surveys returned were barely reflective of statistically valid sample, it is important to note the occupational category of Environmental Technology is an emerging technology. Consequently, many businesses and organizations which responded might not be familiar with environmental technology as an occupational category. As demonstrated from the listing in question 5, the persons responsible for environmental issues and safety have many job titles.

Our employer need survey indicated that 11 employers are willing to serve as cooperative sites for students. Employers who indicated an interested in cooperative education are: Rone Engineers, environmental consulting services; Delta Environmental, environmental consulting; Pro-Line Corporation. personal care product manufacturing; Sandoz Agro Inc., specialty chemical manufacturing; Custom Analytical, specialty laboratory services; Enserch, research and development; Conlan Engineering Co., environmental consulting; Dallas Wiping Materials, textile manufacturer; Heat Energy Advanced Technology, treatment, storage, and disposal; Analytical Food Laboratories, testing laboratory; and City of Lewisville, environmental services.

PROJECTED STUDENT AND GRADUATE DATA

In order to assess the level of interest and potential enrollment in the environmental technology program, students currently enrolled in general chemistry courses were surveyed. The survey (Appendix M) distributed to 52 students included general information about the program and potential placement opportunities for graduates.

Out of the 52 responses, 21 students (40%) indicated an interest in an environmental technician's career. Of these 21 students, 16 or 30.7% of the students indicated that they would be interested in receiving additional information or studying environmental technology at Brookhaven College.

The average enrollment in the sciences at Brookhaven (chemistry, biology, geology, and physical science) is 450 per semester. Idealistically, extrapolating from the 31% of respondents interested in studying environmental technology at Brookhaven, approximately 150 would be potential students. However, a more realistic interpretation using 10% of the above figure would give us a beginning class of 15. With a projected enrollment of 15 to 20 per semester, 60-80 could be enrolled at any one time in various parts of the program.

LINKAGES AND DEMONSTRATION OF NON-DUPLICATION

Other than currently enrolled science students, there are several additional sources for the recruitment of potential students. For example graduating high school students from the feeder schools, persons who are making second-career choices, and individuals already working who want additional training.

High school students will be recruited from R.L. Turner, Newman Smith, W.T. White, Thomas Jefferson, Lewisville, J.J. Pearce, Marcus (Flower Mound), The Colony, Highland Park, Jesuit Preparatory, and Ursuline Academy.

Information will be made available through college night activities and the mailing of brochures telling about the program to high school counselors. Advertising in local newspapers and widely circulated magazines would be needed to reach individuals considering a career change. Local periodicals will be used to reach large numbers of residents; the *MetroCrest News* covers many local issues and events. Advertising, announcements, or press releases to larger papers would also reach large numbers of individuals; the *Dallas Morning News* and *Fort Worth Star-Telegram* both regularly include education sections where careers and career trends are presented.

Another potential source of students will be from the existing local environmental industry. We will be targeting adult workers who are seeking additional training in order to advance in their present job or to be considered for promotion. The *RETORT* is a professional journal published by the American Chemical Society in the Dallas-Fort Worth area that is distributed to more than 1200 workers in related fields. By placing an advertisement or a mini article in this journal, the *RETORT* could become an important tool in our recruitment efforts.

Non-duplication is demonstrated by the absence of such program in the immediate service area. The closest program dealing with a related area is in Waco, Texas.

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MINUTES
ENVIRONMENTAL TECHNOLOGY
LOCAL ADVISORY COMMITTEE MEETING
June 1, 1994

The first meeting of the Environmental Technology Advisory Committee was held on June 1, 1994 in room T313 at Brookhaven College.

Those present for the 7:30 a.m. breakfast meeting included:

Bruce Bailey, ATEC Associates
John Corn, Armstrong Forensic Laboratory
Danny Dunn, Alcon Laboratories
Don Eubanks, Texas Natural Resources Conservation Commission
Jared Fuqua, Fluor Daniel, Inc.
Walt Helmick, U.S. Environmental Protection Agency
Connie Hendrickson, Brookhaven College
Marilyn Kolesar, Brookhaven College
Linda Lee, Brookhaven College
Ricks Pluennecke, The Plant Pro Advisory Service
Patricia Smith, Texas Instruments
E. Thomas Strom, Mobil Research and Development

Also in attendance: Naomi Garrett, Office for Career and Continuing Education, DCCCD

Dr. Larry Darlage, Vice President of Instruction, Brookhaven College, gave a warm welcome and provided the members an overview of the environmental technology program. He indicated that as a former chemistry instructor, he felt a strong personal affinity with the potential and importance of the proposed program.

Following individual introductions, Linda Lee, Director of Instructional Development and Project Director for the Coordinating Board - Environmental Technology Grant, opened the committee meeting referencing an article form the August 1991, *Fiscal Notes*, "The environmental industry is growing rapidly, but the common definitions and statistics needed to describe the industry are only now emerging." Government agencies aren't systematically compiling the data on related businesses, but private studies are beginning to provide a "statistical snapshot". *The Environmental Business Journal (EBJ)* developed a profile of 61,600 U.S. environmental companies. The combined annual revenues of those companies represented $132 billion in 1990. Further the *EBJ* reported "that $45.8 billion in revenue was received by public companies and of that number, 22 Texas firms accounted for 13 percent or 5.9 billion of the total."

Linda explained that this local advisory committee represented a new source of information and input for the development of a new program to train individuals for employment as environmental technicians. As background information into the process she explained that thus far, there had been two meetings of a statewide advisory committee that included educators and representatives from the field of environmental technology. In addition, a two-day DACUM was completed in November 1993. (A DACUM is a process for job analysis. It requires a facilitator and a panel of experts who identify, over a two day period, all of the duties and tasks pertinent to a specific job. In this instance the job title was Field/Laboratory Technician.) The DACUM Panelists worked to produced a charting of duties and tasks for the position of Field Laboratory Technician. The duties and tasks were then validated, via a survey, with another representative group of environmental professionals.

Once this process was complete, a Crosswalk of all of the duties and tasks was undertaken. Basically, the Crosswalk is a convenient term to describe the process for considering each of the task/duty statements in terms of the required cognitive, affective and psychomotor levels of instruction; whether or not the information is currently taught in an existing course; or if a new course needs to be developed. The Crosswalk produces a visual charting that forms the basis from which the curriculum plan begins to emerge. Lee indicated that in our [the local advisory committee] work today, the group will be reviewing directly and indirectly input from all that has happened to this point as it relates to the curriculum patterns and the courses that support the proposed Environmental Technology program

Marilyn Kolesar who, if the proposed program is approved by the Coordinating Board, will be the administrator for the Environmental Tech program, gave the committee a breakdown of why they were asked to participate and how they will be involved. She invited their full support and involvement in the review of curriculum materials and in making any additions or corrections that are necessary both before the program is presented to the state for approval, and once the program is underway. Marilyn clarified that we will be training entry level employees as Environmental Technicians. This Advisory Committee will be looked to for advice, ideas, leadership, resource people, visitation sights for our students, and as possible sources for cooperative work opportunities for our students. This committee, in effect, represents the professionals who will provide the linking partnership between industry and education. It is hoped that the program can be implemented in the Spring of 1995.

Connie Hendrickson, Content Specialist, discussed the core curriculum as it is to be implemented. Potential new courses and core course requirements were reviewed. It was emphasized that what was proposed would not be a specialty program, but a general program having heavy chemical "underpinning."

The ENVT prefixes are new courses. English, speech, and math are required courses for the Associates Degree. Several of the courses in the Associates Degree plan should be transferrable to a four-year college.

Connie pointed out that the "DRAFT" core curriculum handout includes short course descriptions and course learning outcomes, both of which come directly from the DACUM.

Comments on individual courses:

> ENVT 101 - Introduction to Science and Safety is a "heavy duty" safety course which the DACUM panel and statewide advisory committee said was necessary. There will be an introductory course in air, soil, and water pollution (ENVT 101).
>
> ENVT 101 - The curriculum will include courses in lab and record keeping. The DACUM panel emphasized that it was essential to prepare workers knowledgeable of the workings of a spreadsheet. Experience with a word processing program and the use of data based software was equally important.
>
> BIO 223 - Environmental biology will give the student a good background for those that will be doing field work and it is transferrable.
>
> CMT 124 - Electrical and Mechanical Equipment for Buildings was another committee contribution. This course is already taught at Northlake as part of their program in construction. As such, it is an approved course.
>
> ENVT 106 - Calculations for Environmental Chemistry-- most graduates do not have experience in setting up word problems in math.
>
> ENVT - 202 Hazardous Materials; the core curriculum concentrates on handling of hazardous materials. This course would satisfy OSHA requirements.
>
> ENVT - 206 Industrial Processes and Procedures is an overview of major chemical industrial processes. It discusses different kinds of tracking and transportation of materials, on-site field testing, on-site experience. ("Nothing takes the place of your first job--not even a coop program.")

The certificate program is aimed at those students who have exited and are returning, or will exit after they have completed their certificate requirements. It includes the employee's "right-to-know " information.

This comment lead to a discussion on the need for advanced skills courses or a possible certification attesting to skill attainment in materials analysis and regulatory compliance.

One of the committee members suggested that there was a need for exposure to hydrology and it was suggested that this would probably be covered in an advanced field course--an overview of ground water movement (e.g. introduction to soil chemistry--the movement of water thorough soil zones).

Don Eubanks brought up the subject of contaminants. It was felt that these needs would be covered in hazardous wastes.

Walt Helmick suggested that more information in any one subject might be covered in the "free electives" designation.

Marilyn Kolesar noted that the last 15 hours must be in residence. Because this program will produce an entry level person, there will be a heavy emphasis on lab time.

John Corn inquired as to how many hybrid courses are transferrable -- Marilyn Kolesar indicated that at this point, we don't know. She clarified that these details will be on hold pending the program's approval.

Connie Hendrickson mentioned that she knows that the University of North Texas has an environmental program in the developmental stage.

John Corn asked Marilyn how long the student was given to complete the program? Answer: from Marilyn Kolesar, five years.

Linda Lee mentioned that the environmental tech team was also working to create a Tech Prep partnership with Coppell High School, but that the individual time lines for both the college and the high school will make it impossible to have completed the Tech Prep plan before the proposed program application is submitted to the Coordinating Board.

Walt Helmick mentioned that the makeup of the committee from education and industry evolved because we had one common goal--producing a competent work force.

John Corn asked the question: "Is it possible to use this program as a basis for a four year degree in chemistry?" Answer: While we recognize that some of our students will be continuing into a four year program, that is not the purpose for the program. For the most part we are educating students to begin entry level jobs.

Walt Helmick suggested that another good use for the program would be for people who need retraining. (Someone else mentioned that the Geotechnical Environmental program in continuing education is geared toward retraining.)

In concluding the discussion portion of the meeting, Lee reminded the group of the SCANS activity that would formally conclude the morning's session. Committee members were asked to complete the SCANS assessment sheets from the perspective of a potential employer and indicate which of the competencies listed would be most valued in an employee.

One additional comment from Ricks Pluennecke regarding the importance of communication skills was noted before the close of the meeting. It has been his experience that communication skills have not been given adequate attention.

The Advisory Committee was thanked for their interest and participation in the development of the proposed program and the meeting was adjourned.

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BROOKHAVEN COLLEGE
STATEWIDE ADVISORY COMMITTEE MEETING FOR THE ENVIRONMENTAL TECHNOLOGY COORDINATING BOARD GRANT
October 15, 1993

Present: Mary A. Brumbach, Susan Couch, Pam Dahmen, Bruce Bailey, R. Steven George, Stephen C. Head, Walt Helmick, Connie Hendrickson, Kimberly Kass, Linda H. Lee, Dick Lodewick, Jan Mayberry, Sue Pardue, Barry Russell, Terry Squier

Welcome and Introductions: Linda Lee, Director of the Environmental Technology Grant, and Dr. Larry Darlage, Vice President of Instruction, Brookhaven College welcomed Environmental Technology Advisory Committee to Brookhaven College.

Grant Overview: Dr. Mary Brumbach -- referenced the new mood in the state of Texas, that it is no longer possible to develop programs for jobs that don't exist. Most of the jobs in the next three years will be in the small business sector. And it is also estimated that during in the next three years, jobs in the small business sector will increase from the current 286,000 to 696,000.

Objectives for the business community include employees who :

- are trained to go to work.
- have work place competencies.
- are comfortable and competent in the use of technology.
- have basic skills -- writing and thinking plus with high ethical standards and integrity.

Texas is 47th in the nation in terms of federal dollars used for support.

Focus of the grant is to produce a manual that will help to disseminate a curriculum model for environmental technology that can be referenced and used throughout the state of Texas.

Linda Lee indicated the goal for this Advisory Committee meeting is for everyone to contribute their perceptions of the components for an environmental tech curriculum. After the meeting concluded, everyone would leave with an understanding of what we are trying to accomplish and would begin to think in terms of how the type of program being discussed might impact their own campus.

Methodology

Linda Lee and Dr. Connie Hendrickson, Content Specialists for the Environmental Tech grant lead discussions on the methodology and related topics.

a) Developing a Curriculum--a process for job analysis. A process wherein a panel of expert workers is assembled for a two day session. During this time, it is the responsibility of the panel, working with a facilitator, to define and refine the specified job in terms of its job definition and its duties and tasks. This process ultimately identified, in detail, workplace competencies required for a specific job.

Concerns were expressed that the workloads that environmental techs handle might make it difficult for managers to release their best workers for two days. (One committee member indicated that this reality also spoke to the need for train technicians in environmental technology.) Dr. Hendrickson indicated that while this was a realistic concern she had already received commitments from some of the major businesses in the field.

Other questions were raised regarding the diversity of workers represented on the panel. It was pointed out that to date, individuals contacted included bench technicians, and those from production and facilitation including representatives from Alcon Labs, BeautiControl, Exxon and Armstrong Labs.

b) Titles and Definitions for an Environmental Technician:

Connie Hendrickson clarified that an environmental technology program would not necessarily target a single need such as air, soil and water, industrial hygiene, or hazardous materials. The work of an environmental technician might touch on some or all of these specialties. Typically an environmental technician is the type of person who participates in some kind of testing. Many might fall into the category of Chemical Bench Technicians, but others would work in the field or in a nontraditional capacity. (The American Society for Testing and Materials, is recognized as the organization that sets the standards for testing.)

Connie referenced the TIINS definition in the handout package, and her unifying definition of Environmental Laboratory Technician was discussed.

Some committee members saw environmental technician in classifications for both professional and nonprofessional workers. R. Steven George pointed out the need to understand both procedures and processes, that environmental technicians conduct both tests and field applications

During the exchanges, the job title Environmental Laboratory Technician was a point of concern to several committee members. It was discussed, throughout the meeting, as maybe not the terminology that should be used. Also noted was the title of "Bench Laboratory Technician" as being too limiting.

The Advisory Committee felt that the term Environmental Technician was much broader. The word "lab" was felt to indicate one person sitting in a laboratory running tests. Environmental Lab/Field Tech was also suggested as a possible job title for graduates of the program.

Other related comments for considerations included the following:

Terry Squier felt that we should be more interested in what people do; i.e. construction, manufacturing, community government, real estate and insurance (Phase I and Phase II evaluations), using documents to collecting information and with varied media or data bases.

Barry Russell felt that the program should be aimed at the person seeking at least an Associate degree such as an Environmental Lab Tech/Field Tech And, that they should have training in the health and safety aspects. However, he felt that there must also be a route for these people to take a job out of high school, this might include OSHA training.

Bruce Bailey expressed an interest in a course in safety and regulations; perhaps with 40 hours of safety training, the student will be employable. However, others indicated that these specialty type of training sessions were already available at various locations in Texas.

Helmick in referencing OSHA training expressed the desire for more training on toxicology and hygiene risk; that both needed to be heavily reinforced.

Stephen Head noted the need for instruction in legal and ethical issues.

Kimberly Kass emphasized the importance of including industry in the program's development.

Terry Squier wanted consideration given to how and where graduates of environmental tech programs people might be employed. He felt that as an Advisory Committee, we should plan for the future and not from the past.

Dick Lodewick alerted the group to the necessity of flexibility, and to assure that students would not become boxed into a profession.

Environmental technology, as a field, is less than 20 years old. Stephen Head spoke to the importance of industry standards.

Connie mentioned that the American Chemical Society has recommended guidelines for programs training chemical technicians.

R. Steven George pointed out that he is a product of a program similar to the one being proposed. And that he became involved in the field after he already had a B.S.

Because of the breadth of ideas being exchanged a two minute summary was suggested to bullet key point for the group, the summary follows.

Two Minute Summary:

From the board:

- Knowing data sources
- Spreadsheets and word processing
- Report writing
- Health and safety
- Emphasize technical competencies
- Broad spectrum of participant types
- QA/QC Considerations
- Interpersonal/TeamBuilding (SCANS)
- Legal and ethical considerations
- Regulatory compliance
- Possibility of certification
  - Capstone experience
  - Associates degree
- Futuristic -- practice vs reactive planning form the future

- Environmental Technician
- Environmental. Lab/Field Tech
- Environmental Scientific Technician
- International Application

- Interaction with existing programs

- Linking with industry

What Happens Next? Linda Lee provided the following highlights:

a) Finalize planning for DACUM, November 4 and 5, 1994. The DACUM will be held at the Jan LeCroy Center on Richland's campus. Advisor Committee members are invited to attend; however, the grant cannot pay for transportation.

b) Once DACUM is complete, information will be validated with other professionals to confirm accuracy.

c) A "Crosswalk" team will be assembled. This group will include representatives from business and industry (hopefully participants from the DACUM panel who will be able to clarify rationale for some of the duties and tasks), and representatives from the science faculty who will review the DACUM results, the validation results and identify basic patterns from which the curriculum pattern will be developed.

The advisory committee considered possible meeting dates for spring, 1994. The date of April 22, 1994 was selected.

Meeting was adjourned.

BROOKHAVEN COLLEGE
STATEWIDE ADVISORY COMMITTEE MEETING FOR THE ENVIRONMENTAL TECHNOLOGY COORDINATING BOARD GRANT
April 22, 1994

Present: R. Steven George, Walt Helmick, Connie Hendrickson, Kimberly Kass, Marilyn Kolesar, Linda H. Lee, Dick Lodewick, Jan Mayberry, Chuck McCarter, Sue Pardue, and Barry Russell.

Welcome and Introductions: Linda Lee, Director of the Environmental Technology Grant, Dr. Larry Darlage, Vice President of Instruction, Brookhaven College and Dr. Mary A. Brumbach, Director, Resource Development, Brookhaven College.

Update: Linda Lee reported on the following:
* The Environmental Tech DACUM was held November 4 & 5. Lee reported that, repeatedly during the first two days of the DACUM, panelists kept repeating that business/industry were seeking a competent worker with background in the sciences, particularly chemistry, a person who is trained to perform in the field and in the lab.

* The team had received a 47.2% return on the DACUM Validation survey. One hundred fifty-nine surveys were sent to A.I.C. (American Institute of Chemists) members and 28 were sent to members of the American Accredited Laboratory Association.

* About a week ago, using the Standard Industrial Classification (SIC) codes as a basis for selection, a Needs Assessment was sent to 1386 businesses in environmentally related fields. Replies to that survey were being received.

* A committee that included both faculty and representatives from business and industry met on March 25 and 30 to complete a Crosswalk based on the DACUM identified duties and tasks. These two days of discussion provided the basis for curriculum planning from which the curriculum pattern is being fine tuned.

* Tech Prep explorations are under way.

* A letter of intent for the program has been forwarded to the Coordinating Board.

* SCANS Competencies are being integrated into the organization of class materials.

Discussion of Curriculum: Dr. Hendrickson shared that her original plan for the program had 90 hours but had been pared to 72 hours. Both Quantitative Analysis and Instrumental Analysis are included in the program.

Comments from the meeting's participants follows with discussion notes in brackets.

Sue Pardue -- questioned why there was only one semester of math? [A review of the catalogue clarified why course was a fit and in addition math skills were augmented by ENVT 106.]

Connie Hendrickson -- emphasized importance of computer skills for environmental tech graduates

Marilyn Kolesar noted her strong sense that the DACUM truly drove the program's curriculum.

Kimberly Kass -- high level of expectation in the field...that breadth of training improves options for lateral movement in the profession

Walt Helmick -- sought clarifications on Chemistry 101 and Math 101

Sue Pardue -- "what about the student who got a GED 20 years ago before there was computer training? [ENVT 102 designed to fill this need]

R. Steven George endorsed the importance of computer classes, noting that he had never touched a computer until age 30 when he took a crash course.

Marilyn Kolesar -- ENVT 102 was the source for computer training which included basic spreadsheets, word processing and working with data based software as they relate to the profession.

Kimberly Kass -- computer skills are commonly taught in many high schools and that typically students graduate knowing three software programs.

Sue Pardue -- questioned if the curriculum was overly ambitious for a student at the Associate Degree level?

Chuck McCarter -- had questions about the term "free" electives. [However, this was a required term used in Brookhaven College curriculum patterns.]

R. Steve George noted that "documentation" assignments were usually "dumped" on entry level workers which was one on the reasons for requiring strong communications skills.

Connie Hendrickson -- confirmed that ENVT 101 would cover material safety and data sheets and the protection of people and equipment.

Walt Helmick -- recommended that we take out references to professional and government organizations, i.e. OSHA and EPA and instead use generic terminology.

Walt noted that instructor certification in some instances is just a matter of taking the course and that no testing is required.

Barry Russell -- questioned if some things were already in place for the new courses-- i.e. textbooks, equipment, etc. [One of the advantages of this proposes program was that campus could share existing resources for Chemistry/Biology, use newly renovated labs. In addition, the campus had committed budget dollars to new supplies, resources and equipment needs once program is approved, hopefully, for spring 1995 implementation. Application for the Environmental Tech program to be submitted to Coordinating Board August 1994.]

Barry Russell -- is articulation to BS degree planned? Has the assumption has been made that graduates want to go on to advanced degrees i.e. agriculture, oceanography, etc.? [Program's primary objective is to prepare graduates for work in environmental technology fields. However, once the program is underway networking with area four year institutions, such as North Texas, will be important. It is anticipated that some of our courses such as Quantitative Analysis will transfer to four year colleges.]

Sue Pardue -- complimented the program, particularily, because of its hands-on, field-based approach. She stated that a first program looked "overly ambitious" but based on discussions, she's confident program is well targeted.

Break for lunch

Walt Helmick -- said that he'd shared the proposed Environmental Tech curriculum plan with friends in the field and they were very impressed with the quality and rigor of the program. However, they expressed concern that graduates may not get their "hoped for" salary with their first job.

Marilyn Kolesar expressed concern that nothing will kill a program faster than false expectations regarding salaries in the field.

R. Steve George -- the problem is that companies need the skilled worker, but will not have large salaries to offer the entry level person until he/she proves themselves.

Walt Helmick -- entry salaries can be discouraging, but once "in" and the person becomes "valuable" their salary potential will rise dramatically. The distinction is this, most entry level workers, with and without training, will begin at a relatively low salary, but those with a background and training from a program like this, will see their salary potential take-off and the non-trained worker's salary will remain relatively level.

Marilyn Kolesar -- referenced importance of assuring career counseling for students on salaries so that all would know what to expect.

Walt Helmick -- government jobs will begin at about GS-5 level. Also, small industries will be the ones who can take advantage of the people trained through this program, once workers become specialized, they will see a jump in pay. People will be working toward job security over the long haul.

R. Steve George -- agreed with Walt and added that practical skills are needed in a small business. He suggested advanced skills certifications in areas such as transfer of fluids, field applications, basic electrical work, etc. "If there was a way to add some things to the program without getting rid of anything, I'd like to see students know something about plumbing, electricity, power sources, how to make simple repair in the field, troubleshooting... people in the trades need to know what to do if something goes wrong." [General discussion followed that centered on the need for practical, real world skills particularily if the student can show advanced skills certification.]

Marilyn Kolesar -- physical world skills, workers either get experience on the job or from a program like this. [Reading from the catalogue -- Construction Management Technology at North Lake College, agricultural mechanics is already in place, the blueprint of the course is for 2 hrs. (1 lecture, 2 lab.)]

Walt Helmick -- graduates need the ability to run survey equipment and be able to map something. Channelization, where to put the filter, to do this might give the student a little more skill/flexibility in which to work. Idea could be incorporated into advanced skills certificate.

Because of time constraints Linda Lee noted the need to wrap-up the meeting. Her statement was interrupted by comments of congratulations to the team of Connie Hendrickson, Marilyn Kolesar and Linda Lee for their work on the Environmental Tech program. There were numerous and enthusiastic expressions of endorsement and support for the curriculum plans as presented.

In closing, Linda Lee announced that while the work of this committee (the Statewide Advisory Committee for the Environmental Technology Grant) was concluding, the work of a new Advisory Committee for the program would begin very soon. That a local advisory committee that was to included representatives from business and industry would be assembled in the next few weeks. Linda extended an invitation for members of the Statewide Advisory Committee to consider volunteering to serve and/or recommend possible participants. Responsibilities and anticipated time involvements for the local Advisory Committee to the Environmental Technology program were discussed.

The Statewide Advisory Committee was again thanked for their splendid contributions and the meeting was adjourned.

ABILITY TO PROVIDE INITIAL RESOURCES

The proposed program will have one full-time faculty member who will coordinate the program. During the initial stages of the program, this person will teach introductory courses, but will also be responsible for marketing the program, making community contacts, arranging cooperative work experiences sites with local industry, etc. The bulk of the Environmental Technology courses will be taught by adjunct faculty from local industry, businesses, consulting firms, laboratories, and schools.

Existing facilities on the Brookhaven Campus will be used for this program. Core technology classes will be taught in classrooms in the **Q** and **K Buildings**. A fully equipped computer lab (Science/Math Computer Lab, K121) is available for student use. Laboratory space which was recently renovated is located in the **K Building**. The current laboratory, K108, contains eight hexagonal student stations, each equipped with wet sink, natural gas, and compressed air. The laboratory, which includes a total of 1230 square feet, and four exhaust hoods, contains all chemicals, glassware, and small equipment needed for the teaching of courses required for this program. The adjacent stockroom and prep area include separate specialized storage for hazardous materials, solvents, and acids, as well as reference materials and sample storage.

During the renovation of the science building, Room K116, the classroom adjacent to the laboratory, was planned for future incorporation as laboratory space . This lab shares exhaust hoods and access to the stockroom and prep area with K108. All necessary plumbing and electrical connections for a new laboratory are already in place, having been installed during the renovation. The following chart presents an overview of resources required to successfully train the students. Equipment and supplies which are not currently in place will be purchased upon approval of this program application.

FACILITIES AND EQUIPMENT PLAN

INSTRUMENTATION and EQUIPMENT	*Approximate Cost (does not include academic discount)*	*Description*	*First use (year/semester)*	*Currently available*	*Budgeted for coming year*	*Subsequent year funding*
Gas chromatograph	$10,000	FID detector, includes integrator, supplies	Chem 234 (2/2)		✓	
Analytical balance	----		Chem 101/102 (1/1)	✓		
Toploader balances	----		Chem 101/102 (1/1)	✓		
Microscopes Stereoscopic	$650 x 8 = $5,200	basic units for particle sizing, classification	Chem 234 (2/2)			
Microbiological	----		ENVT 105 (2/1)	✓		
Teaching system	$5,000	Viewing system: camera 1800, optics 2000, illumination 500, monitor 600	ENVT 208 (Adv. Skills)			
HPLC	$5,000 $1,200	fixed wavelength detector (254 nm), isocratic pump integrator	Chem 234 (2/2)			✓
Atomic absorption	$8,500 $1,000	Buck Scientific equivalent lamps and supplies	Chem 203 (2/1)			✓
Visible spectrophotometers	----		Chem 101/102 (1/1)	✓		
UV/VIS spectrophotometer	$5,000	200-1000nm	Chem 203 (2/1)			✓
Microscale organic equipment	$2,500	Williamson Method	ENVT 105 (2/1)		✓	

LEGEND =

1/1 - JAN '95
1/2 - SEPT '95
2/1 - JAN '96
2/2 - SEPT '96

FACILITIES AND EQUIPMENT PLAN

INSTRUMENTATION and EQUIPMENT	*Approximate Cost (does not include academic discount)*	*Description*	*First use (year/semester)*	*Currently available*	*Budgeted for coming year*	*Subsequent year funding*
Infrared spectrometer or FTIR	upgrade: $2,000 $1,500	computer for memory storage and demonstration of computer interface ATR sampling accessories	Chem 234 (2/2) Chem 234 (2/2)		✓	
pH meters	----		Chem 101/102 (1/1)	✓		
pH meter with ISE capability and ion selective electrodes	$1,000 x 3 = $3,000 $300 x 6 = $1,800	meters with ion-selective electrode capability electrodes	Chem 203 (2/1)			✓
Centrifuge, small bench-top for qualitative and quantitative analysis			Chem 203 (2/1)	✓		
Centrifuge, large capacity	$2,000 $2,000	base unit rotors (including bucket rotor and buckets for field work)	ENVT 201 (2/2)			
Autoclave	----		ENVT 105 (2/1)	✓		
Additional glassware and chemical	$3,000 - $5,000		Chem 203 (2/1)		✓	
Field work/sample collection			*ENVT 201 (2/2)*			
Sonicator	$100 X 4 = $400	for sample prep work	ENVT 201 (2/2)			✓

LEGEND =

1/1 - JAN '95
1/2 - SEPT '95
2/1 - JAN '96
2/2 - SEPT '96

FACILITIES AND EQUIPMENT PLAN

INSTRUMENTATION and EQUIPMENT	*Approximate Cost (does not include academic discount)*	*Description*	*First use (year/semester)*	*Currently available*	*Budgeted for coming year*	*Subsequent year funding*
Homogenizer	$300 X 8 = $2,400	for sample prep work	ENVT 201 (2/2)			✓
Viscometer	$600 X 2 = $1,200	sets of cup viscometers	ENVT 201 (2/2)			✓
Refractometer	$600 X 8 = $4,800	wide range refractive index values	ENVT 201 (2/2)			✓
Organic vapor analyzer	$600 X 8 = $4,800	hand-held "sniffer" for organic vapors (TCD detector)	ENVT 201 (2/2)			✓
Conductivity meter	$300 x 8 = $2,400	handheld for water analysis (total dissolved solids, etc.)	ENVT 201 (2/2)			✓
pH meters, handheld	$600 x 8 = $4,800	battery operated; with RS232 interface to demonstrate computer interface	ENVT 201 (2/2)			✓
Hygrometer	$300 X 2 = $600		ENVT 201 (2/2)			✓
Dewar flasks	$200 X 8 = $1,600		ENVT 201 (2/2)			✓
Airborne particle counter	$3,000		ENVT 201 (2/2)			✓
Dissolved oxygen/BOD meters	$350 X 8 = $2,800		ENVT 201 (2/2)			✓

LEGEND =

1/1 - JAN '95
1/2 - SEPT '95
2/1 - JAN '96
2/2 - SEPT '96

FACILITIES AND EQUIPMENT PLAN

INSTRUMENTATION and EQUIPMENT	*Approximate Cost (does not include academic discount)*	*Description*	*First use (year/semester)*	*Currently available*	*Budgeted for coming year*	*Subsequent year funding*
Soil and water sampling reagents and supplies	$5,000	Includes field test kits and supplies for a class of 32	ENVT 201 (2/2)			✓
Safety equipment						
Flammable solvents cabinet	----		Chem 101/102 (1/1)	✓		
Acid storage cabinet	----		Chem 101/102 (1/1)	✓		
Head and face shields	$20 x 20 = $400		ENVT 101 (1/1)		✓	
Full-face respirators; cartridges	$200 x 4 = $800; 300		ENVT 101 (1/1)		✓	
Half-mask respirators cartridges	$30 X 10 = $300; 300		ENVT 101 (1/1)		✓	
Self-contained breathing apparatus	$3,000		ENVT 101 (1/1)		✓	
Coveralls; Gloves	$150 x 4 = $600; 200		ENVT 101 (1/1)		✓	
Computers (hardware)			*ENVT 101/102 (1/1)*	✓		
Books, software, and journals						

LEGEND =

1/1 - JAN '95
1/2 - SEPT '95
2/1 - JAN '96
2/2 - SEPT '96

FACILITIES AND EQUIPMENT PLAN

INSTRUMENTATION and EQUIPMENT	Approximate Cost (does not include academic discount)	Description	First use (year/semester)	Currently available	Budgeted for coming year	Subsequent year funding
Reference books	$2,000		ENVT 101/102 (1/1)			
MSDS collection, J.T. Baker		✓		✓	✓	
TX Environmental Compliance	$600					
Handbook of Chemistry & Physics		✓		✓	✓	
Sax and Lewis: Hazardous Chemicals Desk Reference	$100 x 4 = $400					
Sax and Lewis: Dangerous Properties of Hazardous Materials	$500 x 1 = $500					
Merck Index	$55 x 4 = $220					
Chemical Technician's Ready Reference Handbook	$85 x 4 = $340					
Software	$2,000 - $4,000		ENVT 101/102		✓	
Journal subscriptions	$2,000 - $4,000		(1/1)		✓	
Faculty						
Full-time: 1					✓	
Adjunct: 2-5 per semester					✓	✓

LEGEND =

1/1 - JAN '95
1/2 - SEPT '95
2/1 - JAN '96
2/2 - SEPT '96

FACILITIES AND EQUIPMENT PLAN

INSTRUMENTATION and EQUIPMENT	*Approximate Cost (does not include academic discount)*	*Description*	*First use (year/semester)*	*Currently available*	*Budgeted for coming year*	*Subsequent year funding*
Room K116: Upgrade to laboratory status (based on enrollment)		Addition of laboratory benches/connection of plumbing and electrical connections storage cabinets vertical stack exhaust hoods	Chem 203 (2/1) Earlier ENVT courses 101 and 102 can be held in a classroom or other lab (geology, biology, etc.)			✓

LEGEND =

1/1 - JAN '95
1/2 - SEPT '95
2/1 - JAN '96
2/2 - SEPT '96

Brookhaven College is committed to the establishment of this program. Consequently, the college will allocate $ 90,890.00 to the start-up of this program. Each year, thereafter, the funds will be available to maintain the program. The following budget is presented for the first year.

ENVIRONMENTAL TECHNOLOGY
BUDGET

1994-95

Fulltime Faculty & Benefits	$51,200
Fulltime Faculty Summer	$5,000
Adjunct Faculty	$2,490
Classroom Supplies	$8,000
Major Equipment	$13,500
Minor Equipment	$2,500
Software(Instructional)	$2,000
Travel	$200
Telephone	$400
Office Furniture & Supplies	$600
Copier Expense	$500
Printing & Brochures	$1,000
Books & Journals	$1,500
Computer /Printer (Faculty Office)	$2,000
Total	**$90,890**

PRIVATE SECTOR INVOLVEMENT

Brookhaven College will work closely with all community manufacturing regulatory agencies, and other related small and large businesses to provide training and educational opportunities. This will include coordination with other training sources within the area such as the Environmental Protection Agency and the office responsible for the Occupational Safety and Health Act administration. Coordination efforts will be initiated through a letter of announcement after the program is approved. As a result of this, companies will be called upon for developing partnerships. There are no external certifications required for the graduates of this program, at this time.

At this time, there are no articulation plans for this program. However, future plans for this program include developing a Tech Prep program with Coppell ISD. Additionally, other transfer relationships will be explored with senior universities.

CURRICULUM DESIGN

The purpose of the program is to train individuals to function as environmental technician. As stated earlier, the primary objectives of the program are: (1) to train individuals to perform testing and analysis of soil, air, and water samples, (2) apply techniques appropriately to ensure consumer safety, and (3) interpret technical documentation and regulatory statues.

The curriculum was developed in part as the result of a DACUM process (Appendix N). On November 4-5, 1993 a DACUM panel was convened for the purpose of identifying the duties and task performed by the worker of Field/Laboratory Technician. A listing of the panelist can be viewed in Appendix O. The duties and task developed from the DACUM were formatted for validation. On April 15, 1994 the validation survey was mailed (Appendix Q). A chart of the results can be viewed in Appendix R. During the Spring 1994 semester on March 25 and March 30, 1994; a panel consisting of chemistry and biology faculty, the Dean of Automotive Technology, and two industry representative were seated for the purpose of conducting a "crosswalk" of the duties and tasks identified by the panel of expert workers.

As a result of the "crosswalk" process, eleven new courses were designed with 4 of the courses supporting two Advanced Skills Certificates. A matrix of the completed "crosswalk" can be found in Appendix S.

PROPOSED CURRICULUM

ASSOCIATE DEGREE IN ENVIRONMENTAL TECHNOLOGY
1994-95

SEMESTER I

			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	101	Introduction to Environmental Science and Safety	2	3	80	3
CHM	101	General Chemistry	3	3	96	4
ENG	101*	Composition I	3	0	48	3
MTH	101*	College Algebra	3	0	48	3
Elective		Behavioral/Social Science	3	0	48	3
	TOTAL HOURS		14	6	320	16

SEMESTER II

			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	102	Documentation Techniques	2	3	80	3
CHM	102	General Chemistry	3	3	96	4
BIO	223	Environmental Biology	3	3	96	3
SC	101*	Introduction to Speech Communication	3	0	48	3
CMT	124	Electrical and Mechanical Equipment	3	3	96	4
	TOTAL HOURS		14	12	416	17

SEMESTER III

			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
CHM	203	Quantitative Analysis	2	6	128	4
ENV	105	Chemical Processes	3	3	96	4
ENV	106	Calculations for Environmental Technology	2	0	32	2
ENV	202	Hazardous Materials	3	0	48	3
ENV	206	Industrial Processes and Procedures	3	0	48	3
	TOTAL HOURS		13	9	352	16

* **NOTE: SACS General Education Courses are underlined.**

PROPOSED 1994-95 CURRICULUM - PAGE 2

SEMESTER IV			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
CHM	234	Instrumental Analysis	2	6	128	4
ENV	201	Field Sampling and Testing	2	6	128	4
ENV	703	Cooperative Work Experience	1	15	256	3
Elective		Humanities/Fine Arts	3	0	48	3
Elective		Any non-ENV course	3	0	48	3
	TOTAL HOURS		11	27	608	17
	GRAND TOTAL				1696	66

* NOTE: SACS General Education Requirements are underlined.

BROOKHAVEN COLLEGE FICE CODE: 029150

PROPOSED CURRICULUM

CERTIFICATE FOR LABORATORY ASSISTANT
1994-95

SEMESTER I			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	101	Introduction to Environmental Science and Safety	2	3	80	3
CHM	101	General Chemistry	3	3	96	4
ENG	101*	Composition I	3	0	48	3
MTH	101*	College Algebra	3	0	48	3
BIO	223	Environmental Biology	3	3	96	3
		TOTAL HOURS	14	9	368	16
SEMESTER II						
ENV	102	Documentation Techniques	2	3	80	3
CHM	102	General Chemistry	3	3	96	4
ENV	105	Chemical Processes	3	3	96	4
ENV	106	Calculations for Environmental Technology	3	0	48	3
ENV	703	Cooperative Work Experience	1	15	256	3
		TOTAL HOURS	12	24	576	17
		GRAND TOTAL			944	33

PROPOSED CURRICULUM

ADVANCED SKILLS CERTIFICATES
1994-95

Laboratory Analysis			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	207	Environmental Laboratory Instrumentation	2	6	128	4
ENV	208	Extraction and Analysis of Materials	2	6	128	4
	TOTAL HOURS		4	12	256	8
	GRAND TOTAL				256	8

Regulatory Compliance			LEC. HRS.	LAB HRS.	CONT. HRS.	CR. HRS.
ENV	209	Interpreting Government Regulations	3	0	48	3
ENV	210	Employee Right-to-Know Programs	3	0	48	3
	TOTAL HOURS		6	0	96	6
	GRAND TOTAL				96	6

QUALITY STANDARDS

Brookhaven College is committed to maintaining institutional effectiveness through quality programs that are relevant to the needs of the community and our students as they prepare to enter the work force or to be retrained in pursuit of new career opportunities. Over the previous three years, Brookhaven has produced a minimum of nine graduates in each of its active technical occupation programs. The college has a placement rate of 85 percent and a student loan default rate of 11.5 percent.